THE

Malayan Agricultural Journal.

AUGUST, 1931.

EDITORIAL.

The Employment of Trained Asiatics.

In his speech at the opening of the School of Agriculture, Malaya, the Director of Agriculture stated that while the School was founded primarily for the training of Asiatics for the Government agricultural services, the more important direct purpose of the School is that of creating a class of trained men who can be employed as assistants on estates or on the working of their own properties.

A few days after publicity was given to the above-mentioned speech, the Department received the first practical gesture of approval of the aims of the School.

The well-known Agency firm of Socfin Co. Ltd., who are widely interested in both rubber and oil palm properties in Malaya, in a recent letter state their conviction that the School will prove most useful for the Planting Industry which is in great need of qualified Conductors. The letter continues :—

> "We are in full agreement with you that eventual pupils of the Serdang School are to be encouraged by some prospect of future employment and, while we realise the precious support resulting of the posts offered by Government, we are of the opinion that Planting Companies should encourage pupils to join the School by giving them the assurance that they can eventually be employed by them.
>
> "We are pleased to inform you that—we are prepared to employ two of the first lot of men who will be qualified by Serdang School after three years course, and give them suitable jobs in our Technical Department and/or Estates.
>
> "We shall furthermore, each year, until 1940 at least, offer a post on our staff to one qualified pupil of Serdang School.....
>
> "We sincerely hope that our proposition will decide other Companies to join us."

The support of this firm is a stimulus to our endeavours to create a nucleus of Asiatics with a more scientific knowledge of local agriculture, and we at this juncture re-iterate the hopes of our correspondent that similar support may be forthcoming from other sources.

Carp Rearing.

Although Chinese carp ponds are a familiar feature in all parts of Malaya, yet we must confess that we saw no obvious connection between this industry and agriculture until the Fisheries Department drew our attention to the value of carp rearing as an adjunct to native agriculture.

Closer consideration of this subject has convinced us that not only may fish rearing prove a valuable asset to the agriculturist, but that the Department of Agriculture possesses the facilities and knowledge to extend and render more remunerative the carp rearing industry in Malaya.

Arising from our co-operation with the Fisheries Department on this subject, Mr. W. Birtwistle, Office-in-Charge Fisheries Department, S.S. and F.M.S. has, at our request, prepared an account of carp rearing which we publish in this number. The article will serve as a basis for further investigations into this subject by the two departments concerned.

It comes as a surprise to learn that these fish are vegetable feeders. The fact that the fish are reared and eaten by very strict Mohamedans in Singapore who would not countenance a suspicion of foul feeding is sufficient guarantee that carp rearing may be developed amongst all classes of the community.

The provision of suitable and adequate food for the fish presents no difficulties and in this direction the Department of Agriculture has already rendered assistance to the Chinese who are engaged in rearing this fish.

The Department of Agriculture suggested that Guinea grass would be a suitable food for the fish. Mr. Birtwistle has now established a supply of this grass and since the preparation of his article has written to state that the fish have decided to eat nothing but Guinea grass and discard all other kinds now. Moreover they have put on weight to a very marked extent.

A difficulty hitherto has been in the transport of the carp from China to Malaya and the subsequent distribution of the fry. The continued introduction of fry is rendered necessary by the fact that, apparently, these species of fish do not breed in this country. The primitive methods adopted in transporting the fry and the enormous wastage entailed thereby renders the retail price charged for the fry rather high—from $3—$5 per 100. Mr. Birtwistle states that he is now getting excellent results by delivery of the fry in hermetically sealed cans furnished with a supply of pure oxygen. The development of this aspect of the industry will go far to encourage an extention of carp rearing in Malaya by making the industry more attractive from a financial point of view.

Pineapple Propaganda.

A new departure in advertising Malayan canned pineapples has been adopted by the Malayan Information Agency in the production of a film to demonstrate the use of Malayan pineapples in the preparation of various dishes.

The film proved to be most interesting and within a few days of its

production it was booked by 31 public cinemas, while further extensive bookings are anticipated.

It is considered that the continued propaganda of Malayan pineapples is proving a factor of considerable importance in the further development of this important local industry.

While prices in 1931 have continued at a low level in sympathy with almost all products, it is noted that the Malayan exports of canned pineapples for the first five months of 1931 amounted to 27,166 tons, valued at $3,320,741, compared with 26,159 tons, valued at $3,620,880 for the corresponding period of 1930.

The Malayan Exhibition.

The eighth Malayan Exhibition may now be viewed in retrospect and many will be prompted to ask whether the event has fulfilled the functions for which it was designed.

We are of opinion that it has served to demonstrate to the small-holder the improvement he might effect in his crops by the employment of better seed and more careful cultivation, and it continues to encourage the village industries which are such an important adjunct to native agriculture.

The stock sections, and in particular the pig section, has undoubtedly impressed the Chinese who were here able to compare the local pig with imported and good cross breeds.

The Exhibition has given the planter an opportunity of getting into personal touch with the officers of the Rubber Research Institute and the Department of Agriculture and has also enabled him to meet the representatives of firms that are intimately connected with the planting industry.

Finally, no less than six Government departments embraced this opportunity of furthering educative propaganda work by staging comprehensive exhibits.

Whatever the financial result may be, the Malayan Agri-Horticultural Association may be assured that they have attained their object and the fact that the Exhibition was held during a time of severe trade depression only serves to emphasise the usefulness of their efforts in directing attention to methods of improving production and thus rendering agriculture more remunerative.

Original Articles.

REARING OF CARP IN PONDS

BY

W. BIRTWISTLE,

Officer-in-charge, Fisheries Department, S.S. & F.M.S.

The rearing of carp is probably one of the oldest industries in the world, and it is highly probable that the Chinese were the first to raise it to the level of an established industry.

Radcliffe in his "Fishing from the Earliest Times" quotes from W. C. W. Yen's address before the Fourth International Fishery Congress, Washington in 1908, who stated that the earliest pisciculturist of ancient China was Tao Chu Kung, who lived in the 5th Century, B.C.

The same author points out that the Chinese did not practise artificial fertilisation i.e. stripping the male and female fish of their reproductive products and mixing them in water contained in some suitable container. This is a very modern development of pisciculture. The Chinese contend that this unnatural method produces a stock of fish which is not sound and they rely on fish hatched from ova which have been fertilised under natural conditions. That they are right cannot be denied, and it is only one indication of the high development of their technique of carp rearing. Their infinite patience, attention to detail, and great powers of observation, however, are the main factors of their success.

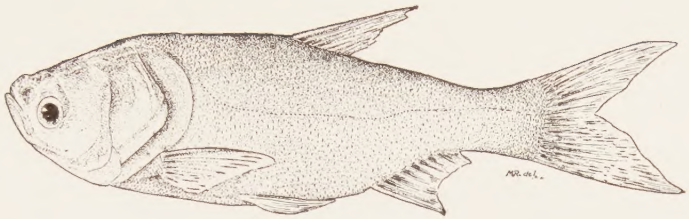
Kinds of Fish Cultivated.

There are five species of carp cultivated in Malaya, viz. (1) *Ctenopharyngodon idellus* (2) *Hypophthalmichthys molitrix* (3) *Hypophthalmichthys nobilis* (4) *Cyprinus carpio* (5) *Cyprinus* (sp. ?). With the exception of the Common Carp (*Cyprinus carpio*) all are imported from China as fry and reared in nursery ponds until they attain a size at which they can be placed in larger ponds and safely left to fend for themselves. The Common Carp will breed in Malaya and is the only one of the five kinds which will do so and it is therefore not necessary to import its fry each season. There is no record of any of the others ever having been found in a gravid condition, but it should be borne in mind that they are invariably eaten long before they have a chance to attain sexual maturity, and an open mind should therefore be kept with regard to this.

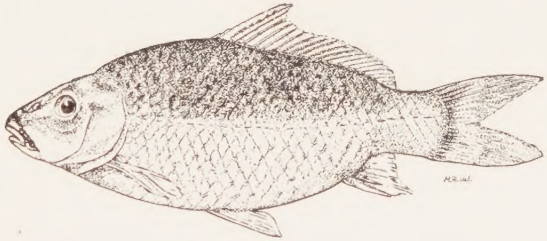
They are all either purely vegetable or silt feeders. *Ctenopharyngodon idellus* is known to the Chinese as Chow Hu the grass (eating) fish, and it lives up to its name since it feeds exclusively on grass and will consume a prodigious amount daily.

H. molitrix and *H. nobilis* are distinctly interesting and are remarkable links in the chain of economy of a carp farm. The Chinese names for these fish are Pey Lin and Twa Tow which mean "White Fish" and "Big Head",

CARP.



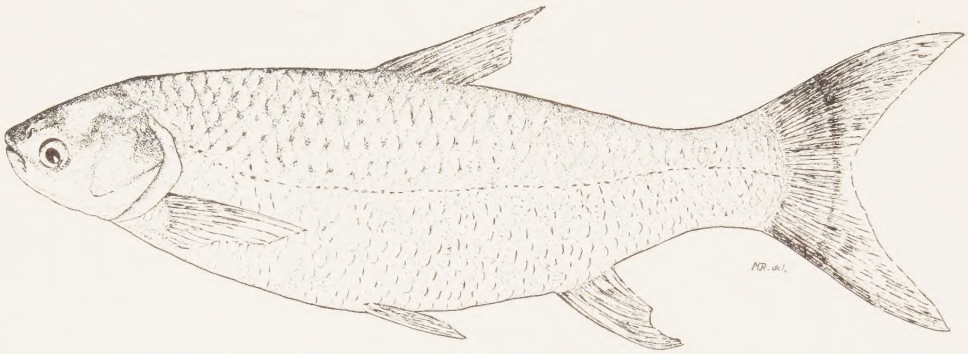
HYPOPHTHALMICHTHYS NOBILI "Big head." (Quarter natural size.)
Cantonese: Tye Tow Yue. Hokien: Two Thow Song.
Grows to 4—5 lbs. in a year.



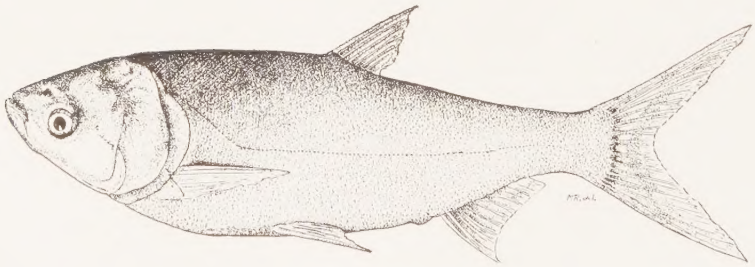
CYPRINUS CARPIO. The Common Carp. (Quarter natural size.)
Cantonese: Li Yue. Hokien: Li Koh.
Grows to about 3 lbs. in a year.

CYPRINUS Sp. (Quarter natural size.)
Cantonese: Tho Leng Yue. Hokien: Leng Chee.
Grows to less than 1½ lbs. in a year.

CARP.



CTENOPHARYNGODON IDELLUS "Grass eater." (Quarter natural size.)
Cantonese: Wan Yue. Hokien: Chow Hu.
Grows to 4—5 lbs. in a year.



HYPOPHTHALMICHTHYS MOLITRIX. (Quarter natural size.)
Cantonese: Pin Yue. Hokien: Peh Leng.
Grows to 4—5 lbs. in a year.

Their main source of food is the faeces consisting of half digested grass voided by Chow Hu—the grass fish. They supplement this by a diet of the rich organic silt from the bottom of the pond. The Common Carp and the other (unnamed) Cyprinid are known respectively in Chinese as Lee Ko and Leng Chee—the English equivalents of the latter are not known. They too, live on organic silt and any small animals and vegetation which may be available. The Common carp, however, thrives on an introduced diet of pea nut cake and, if this can be afforded, it is invariably placed in the water in a basket suspended from a horizontal pole.

Methods of Singapore Fish Culturists.

The cultivator aims at selling his stock within a year, and the fish are usually sold for some festival—Chinese New Year in February being a favourite season. He will then re-stock after cleaning out his ponds and destroying all the predatory fish which manage to find their way there into. He buys his stock from dealers in Singapore who are specialists in rearing the newly imported fry in nursery ponds for stocking purposes.

Food Value of Carp.

The flesh of all species is excellent and liked by the Chinese. There is a danger of a fish which has been raised in a muddy pond acquiring a muddy flavour, and for this reason a pond with a sandy bottom is preferred. The flesh is not only nutritious but very easily digested.

Fat accumulates in great quantities round the intestines and for this reason the fish are doubly prized by the Chinese.

As stated previously, carp breeding is not practised in Malaya. The carp fry is imported from China for stocking the ponds in this country.*

Local Transport of Fry.

Some experimental work has been done in Malaya on the transport of fry with a view to reducing the heavy overhead charges involved in carrying them in bulky tubs and in providing the necessary attendants. The results have been most interesting and follow a method described in Document No. 1045 published by the U.S.A. Bureau of Fisheries, which recommends the use of oxygen as an aid to transport of fishes.

On two occasions consignments, each of 50 fish of common carp fry about 2 inches long, were sent in an hermetically sealed and locked 4½ gallons aluminium

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* The capture of the carp fry in China and its transport to various countries where carp rearing is practised will form the subject of an article in the next issue of the *Malayan Agricultural Journal*.

container, and delivered after a journey of 26 hours with the loss of two fish only in one consignment. The container was completely filled with water and the fish were put in. The lid was then sealed and one-third of the volume of water was displaced by pure oxygen, which rested as a layer on the water at only just a little above atmospheric pressure. The container was put on rail as ordinary freight and delivered to the owner who used the fish for stocking purposes. On another occasion three Hypophthalmichthys weighing about 1 lb. each were placed in a similar container and left for 30 hours at the termination of which they were found to be in a perfectly healthy condition. The container was sealed and a fresh supply of oxygen blown in and they kept for another 16 hours and seemed to be quite healthy.

A consignment of 300 common carp fry about $\frac{3}{4}$ inch long sent on a 24 hours journey by train as ordinary freight in a container furnished with oxygen arrived in excellent condition without casualty. The last part of the journey—40 miles—was made by motor car.

The cost of transport for one container in the case of the two lots of fry plus the return of the empty container amounted to $4. Under the old method it would have meant two men's return fares, costing $21 for fares alone in addition to their pay and food.

The experiment was not carried out on a larger scale owing to lack of staff and to the fact that the fry season was nearly over, but it is intended to repeat the experiment later under actual trade conditions.

Food of Fry and their Growth.

The ponds in which the fry are placed after leaving the ship are, as a rule, small and care must be taken not to overcrowd. A pond 30 feet x 20 feet x $1\frac{1}{4}$ feet deep would accommodate about 2,000 fry ranging from 1 to $1\frac{1}{4}$ inches in length. Australian flour is shaken out of a coarsely woven bag on the surface of the water twice daily, morning and evening. *Ctenopharyngodon idellus* (Chow Hu) will eat in addition a considerable amount of vegetable matter, provided it is in a sufficiently fine condition, and will gorge themselves on the fronds of *Wolffia arrihiza*, a species of duckweed which is cultivated specially as fish food. E. J. H. Corner in the *Hong Kong Naturalist*, (Vol. 1 No. 2) describes the fronds as "minute oval bodies from $\frac{1}{2}$ to $\frac{3}{4}$ millimetre long, rootless, and so firm as to feel gritty between the fingers." They float on the surface of the water in dense masses and form a scum, being devoured by the small Ctenopharyngodon fry which swim just beneath the surface of the water gulping in as many as they can. The supply must be replenished when necessary. The two Hypophthalmichthys, however, will only take the flour and the rich organic silt on the sides and bottom of the ponds, whilst the Common Carp and the other Cyprinid, if present, will devour in addition the entomostracans, copepods, rotifers etc. which abound there.

Growth is very rapid and within a fortnight the fish must be transferred to a larger pond. By this time they will have attained a length of between 2 and 3 inches. The two *Hypophthalmichthys* are the largest, *Ctenopharyngodon* next, followed by the Common Carp and the other Cyprinid, if these two latter are present. The food ration is now augmented, and in addition to Wolffia large quantities of duckweed (*Laemmta paucicostata* and *Spirodela polyrrhiza*) are introduced, primarily for the benefit of the grass fish fry which devour it greedily. A highly nitrogenous food such as peanut cake is also introduced and is suspended in a flat basket tray about a foot from the bottom of the pond. The basket is suspended at three points and attached to a cord hung from the end of a pole held over the pond. One cake is laid in the basket at a time and is renewed when necessary. The cake is the residue of peanuts from which most of the oil has been expressed. It is quite cheap and is exported from China in the form of circular flat cakes about a foot in diameter and $\frac{3}{4}$ inch in thickness. It softens in water and slowly disintegrates into fine particles and falls through the basket to the bottom of the pond. This is an excellent forcing food and is eaten and evidently enjoyed by all species of carp. As much of the cake is put in the pond as the fish will eat. It keeps sweet indefinitely. The fish are retained in the pond until they have attained a length of about 6 or 7 inches, which is a suitable size for sale and stocking, since they are now too big to be eaten by predatory fish. Furthermore, the Ctenopharyngodon can now chew grass and the problem of feeding is not difficult. Any grass which is not too hard appears to be suitable for this purpose. The succulent grass which grows in all wet places is an excellent feed; even lawn mowings will be eaten greedily but the fish will not eat "lalang grass" (*Imperata arundinaceae* Cyrillo. and *I. exaltata* Brongn.).

When the fish have attained a length of 6 or 7 inches they may be placed in a large pond say 100 feet x 50 feet x $3\frac{1}{2}$ feet deep. Such a pond is suitable for 600 to 700 fish of this size. Care must be taken to stock the pond with the correct proportions of the five varieties of carp. It is generally estimated that 50 per cent. of the stock should be *Ctenopharyngodon idellus*, 20 per cent. of *H. nobilis*, 10 per cent. *H. molitrix*, 10 per cent. *Cyprinus carpio*, and 10 per cent. of the *Cyprinid* sp. The two latter species may be omitted, as they are included merely to provide a little extra profit. They do not attain to anything like the weight of the other three species in the same time.

Preparation of the Pond.

It frequently happens that a site may be secured which by taking advantage of natural features is made into an excellent fish pond with no expense other than the construction of a small embankment and a simple sluice gate.

Holes already dug and in many cases filled with water in the abandoned tin mining areas are very suitable. The ground is usually sandy and eminently

suitable for carp rearing and capable of giving high yields of fish. The development of such areas would not only prove profitable but would reduce the incidence of mosquitoes.

A further important factor in fish pond construction is to keep the sides free from overhanging or marginal weeds.

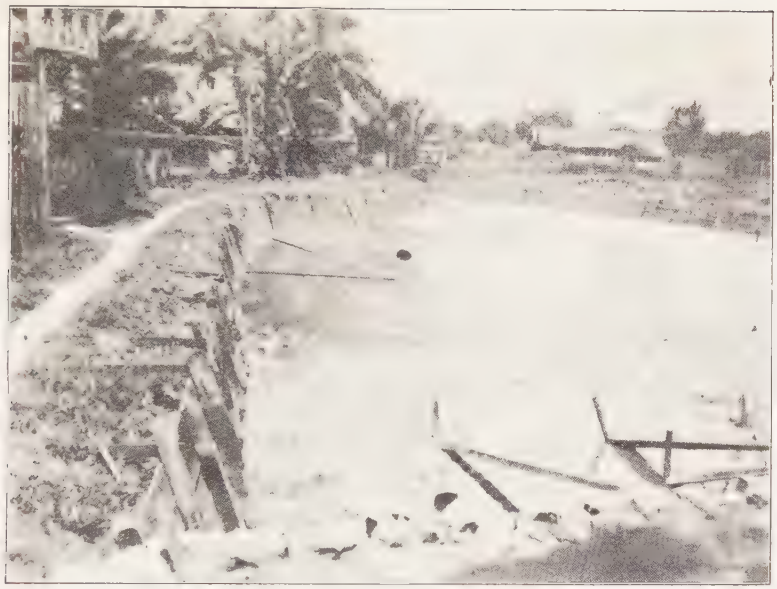
If the pond is to be planked on the sides, the sides should slope back, say at an angle of 15°—20°, and be faced with cheap timber planks 16 feet long x 8 inches wide x ¾ inch thick. The planks are held in place by 3 inch square stakes which are fixed about every 4 feet apart. They are driven into the ground at the same angle as the slope of the sides of the pond and hold the planks flat against the sloped side. Some ponds are dug in ground sufficiently firm not to need side supports of this kind, but they will require attention to prevent the banks from becoming undermined. The tops and sides should be kept free from overhanging weeds as an anti-mosquito measure.

Before the fish are introduced, care should be taken to ascertain that the water is not acid as may be the case in a newly constructed pond. This always happens when a pond is dug on land reclaimed from old mangrove swamp, which seems to resemble peat in its highly acid qualities. Such land should be avoided, but when there is no choice, about 2 tons of cow manure should be placed in the pond and well mixed with the soil at the bottom of the pond to neutralise it. Such a pond should be filled and left for a month before fish are introduced. The acidity appears to be due to the organic acids in the dead mangrove wood and will always be a source of trouble and expense to counteract. This is a most important point and should not be overlooked when choosing a site.

The best ponds are those dug in sandy ground. Old sand pits are the most productive, yield the sweetest fish and require less preparation. At the commencement they will require cowdung at the rate of half a ton for a pond 10 feet x 50 feet x 3½ feet deep. The cowdung not only checks any slight acidity, but furnishes a manure for the algae so essential for aerating the water and a basis for the formation of silt for the silt feeding fish. Similarly, ponds dug in loamy ground are fairly suitable provided that the soil does not contain too much decaying wood. The only drawback in this case is that the fish are inclined to taste rather earthy. A ton of manure would be sufficient to start a pond of the above-mentioned dimensions.

Water Supply.

The water in the carp pond should not be changed or disturbed, and for this reason a stream of water through a pond is not only unnecessary, but a real drawback. The condition essential for the intensive stocking of a pond is that the natural cycle of plant—to animal—to plant through the agency of



A planked carp pond. Note that the planking is secured at every alternate stake by a cross piece nailed to a stake driven into the dry ground. This keeps the planking flat against the face of the inside.

A carp pond shewing the feeding enclosure, formed by three floating bamboo fastened together. It serves to localise the grass as it is thrown on the surface.

bacteria should be adjusted and maintained without disturbance. The waste of one fish will not only provide food directly or indirectly for another, but will assist in providing an abundant supply of oxygen dissolved in the water by maintaining a rich algal growth which performs this very necessary function. Within a short time, the relationships between the physical and chemical conditions of the water, the fish (and other animals) and plants become balanced. The waste of one variety of carp becomes food for another variety.

A carp pond free from mud will be tinted grass green and will be quite free from large-rooted water plants. This colour is almost entirely due to an alga (Microcystis sp.). Such a pond is certain to be well aerated and therefore healthy and productive. Very often, however, this green tint is masked in a pond dug in loamy soil, by the fish grubbing about and disturbing the mud; such a pond should not be condemned on this account.

The question of water supply is never particularly acute in Malaya because of the heavy rainfall, but it is an advantage to have a continuous non-acid supply of water available for "topping up" ponds to compensate for evaporation or leakage. Failing this, it is better to follow the system of the Chinese cultivators who rely on rain water which is probably the safest of all. They usually have a spare pond from which they draw water if necessary.

Temperature of Water.

It is probably due to the uniformity of temperature that such an excellent and steady balance of fish can be maintained in Malaya. The average annual temperature of the water in a pond at a depth of one foot is about 87°F. The extreme ranges may vary from 80° to 90°. On one or two occasions in 1930, when during a hot spell the day temperature of the water was as high as 94°F., no apparent adverse effect on the fish was noticed. The effect of a drop in temperature to 80°F., however, coincided with a phenomenally high mortality among the *Ctenopharyngodon idellus*, a subject which is discussed under the heading "Enemies and Ailments".

Effects of Acidity and Oxygen Content of Water.

A recent innovation in water investigation has been the introduction of various methods of ascertaining the acidity or alkalinity of natural waters by the determination of the hydrogen concentration usually signified by pH value. (Note: A low pH value indicates a high acidity). With older methods it was not possible to say whether a water was acid or alkaline, except when very definitely so, and there was nothing to indicate a very slight variation from the neutral point, and consequently the effect of these slight variations on the life of aquatic animals could not be estimated. With the recent introduction of more exact methods of determining these variations and experimental work on the reactions of aquatic animals to them, much has been learnt. In particular,

more exact information has been obtained on the reaction of fishes to the acidity or alkalinity of the water in which they live. As a rule even a slightly acid water is obnoxious to most fishes and may prove fatal to young carp. It is therefore a matter of considerable importance to know whether a water is satisfactory for their introduction. The Chinese fish culturist, in his great wisdom, has long known this by tasting the water.

Dissolved oxygen will vary in different ponds. As a rule the variation between one pond and another during the day is from 5 c.c. to 8 c.c. of oxygen per litre at the average temperature of 86°F. This variation is accounted for probably by the quantity of algae growing in the ponds which are more abundant in some than in others. On one occasion, when fish died in large numbers, the oxygen content in the pond was found to be as low as 2.5 c.c. per litre. All the common carp, Hypophthalmichthys, survived for three weeks and the mortality was entirely among the *Ctenopharyngodon idellus*. It might be argued that the low oxygen content of the water was the direct cause of death, but against this may be cited the case of another pond in which mortality was equally high, with an oxygen content of 7 c.c. per litre at 85°F.

The pH values in a cultivated pond may vary from 6.5 to 8. A newly excavated pond in mangrove will show a pH of 4.

During rainy weather the pH value of the water in a pond may drop from 7.5 to 6.5 if the rain quickly finds its way into the pond. This will be adjusted in the course of two days provided there is not more rain. Rain water seemed to be the cause of the death of many young carp in a newly constructed pond in which the pH value of the water was normally between pH 6.5 and pH 7, a drop to pH 5 caused by the rain water draining into the pond being more than the young fish could stand.

Carp Pond Foods.

Analyses made by Prof. J. Rosedale, Professor of Biochemistry at the Medical College, Singapore, and Mr. E. P. Jasinghe, of some of the foods of carp are appended below.

Chemical Analyses of Carp Pond Foods.

Samples obtained from Li Ji Siew's ponds in McPherson Road, Singapore.

	Water Percent.	Ash Percent.	Nitrogen Percent.	Fibre Percent.	Ether Extract Percent.
1. Duckweed	93.456	1.592	.3908	.731	—
2. Microcystis	93.364	1.024	.525	.229	.265
3. Bottom Scrapping of pond	72.07	23.16	.0074	—	.118
4. Bean Meal	13.62	4.01	6.998	4.151	7.559
5. Flour	14.85	.46	2.400	—	.644

Fattening Pond.

Returning now to the batch of 600—700 grown fish, which it is assumed have been put into a good pond, steps must be taken to provide the necessary food. For *Ctenopharyngodon idellus*—the grass eater—a simple enclosure of three bamboo poles secured at right angles is made. These are floated on the surface of the water and when the free ends of the two parallel sides are pushed into the bank a rectangular area is bounded on three sides by the flaoting poles and on the other by the bank. If a corner of a pond is used, only two floating poles are necessary. Grass is scattered on the surface within this area and is thus prevented from blowing about.

The fish soon become accustomed to the feeding places. Prof. Y. T. Chu of St. John's University, Shanghai, states that *Ctenopharyngodon idellus* first cuts the grass sideways with the lateral dentations of the comb-shaped teeth against the dorsal plate. The "White Fish" and the "Big Head", *H. molitrix* and *H. nobilis* must content themselves with the excreted faeces of the grass eating fish and in fact this is their main food. The faeces of this fish are cylindrical and float on the surface of the pond in curved lengths varying from 1 to 4 inches. They are firm and composed entirely on half digested grass and will remain on the surface of the water for a long time before disintegrating.

The grass fish will require daily not less than a quarter of their own weight in grass and it is advisable to have the supply at hand. When the fish have grown to marketable size, the provision of grass is no light matter, since for a hundred fish this will necessitate securing about one cwt. of grass each day.

In swampy grass land, a comparatively small area will be sufficient as the cut grass regenerates quickly and is soon ready for cutting again.

The fish will eat the fleshy stems of banana plants and maize leaves, but these do not grow either quickly enough or in sufficient quantities to be used as a general food. Steps should therefore be taken to lay out sufficient ground for grass production. Experiments in this direction are not completed and it cannot be stated exactly what grass growing area will be required, but promising results have been obtained by planting Guinea grass, a quick-growing good fodder grass, close to an experimental pond with a view to ascertaining the value of this grass as a food.

It is a common assertion that one of the articles of diet supplied to carp is human excreta. There is no evidence to confirm this, but the fact that the Chinese builds his small wooden bath house over the pond is probably responsible for the statement. It should be remembered also that the Chinese consider that human excreta is too valuable to use in this way owing to its use for vegetable culture. Sometimes in the absence of any other manure, Chinese will use a small amount of liquid night soil in a deep pond, when necessary, but the dilution is instantaneous and so great that it could not possibly be used as food by the fish. It is put in as a fertiliser, not only to stimulate the growth of algae and to improve the oxygenation of the water, but to enrich the silt in

the normal way of manuring. The Chinese also state that it will raise the temperature of a pond. The actual amount which might be used in a pond 100 feet x 50 feet x 3½ feet would never exceed sixteen gallons per annum, and would be introduced in small quantities at a time. Even if it were all put in at once, the dilution would approximate to 1 in 10,000. Occasionally, the bath house may be used as a latrine and the faeces are sometimes eaten by the cat fish (Clarias), a fish which generally manages to find its way into the ponds, but which is of no value.

The Chinese say that human excreta is only used in deep ponds between 5 feet and 7 feet deep, shallow ponds needing only cow manure. There is definite evidence that human excreta can be dispensed with and the pond in Alkaff Gardens, Singapore, is an example where big carp up to 30 lbs. in weight thrive without it. A pig pen may drain into a fish pond, but again the dilution of the excreta is so great that it does no harm, neither does it become offensive.

Stocking and Estimate of Yield.

With careful attention, losses of fish should not exceed 30 per cent. Such losses generally occur during the early stages of development and the greatest danger is overcrowding. Not only is this likely to cause death among the fish but it retards their growth. Steps should be taken when the fish are ten inches long to reduce the number. There is some difference of opinion as to how many fish should be allotted to a unit area but a safe figure is to allow a fish, when 3 or 4 pounds in weight, 50 square feet of surface area in a depth of water 3½ feet to 4 feet. Thus, a pond 100 feet x 50 feet x 3½/4 feet deep should rear 100 fish to a marketable size of approximately 4 lbs. in weight within one year. This figure excludes the Common Carp and the other Cyprinid which will probably only attain weights of 1½ lbs. and ½ lb. respectively in this period. The varieties of fish must be assorted in proportions mentioned previously and precisely the same method of feeding continued as before thinning out.

Enemies and Ailments.

There is always a danger from water snakes and sometimes otters and only the keenest vigilance can deal with these. Snakes are extremely difficult to keep out as they seem to gain access to the pond when they are small, and are very skilful in concealing themselves. For this reason wire netting is often a waste of money. They can hide in the mud and need only occasionally come to the surface for air, for this purpose putting out very quietly just the tip of the nose. A snake, 3 feet long, will swallow a fish ¾ lb. in weight and it is only when they have taken a fish and come to the surface that they are detected.

Although, as stated previously, acidity of the water will soon prove fatal to fish, excessive alkalinity is not without its bad effects. This latter condition

may occur as a result of overcrowding or overmanuring of the ponds. When the ammonia value become high, say 0.0005 per cent. it has been noticed that the fish may become badly affected with Lernean Copepod parasites, which the Chinese will remove one by one, at the same time, removing the fish to a less crowded pond. Similarly the two Hypophthalmichthys are liable, under such conditions, to become affected on the body with red sores not unlike Furunculosis in salmon. The Chinese are well aware of the contagiousness of this complaint and take prompt steps to net all the fish and to transfer those affected to an isolation pond.

A drop in temperature occasions great anxiety since little can be done to counteract it. During the unusually cold and wet weather in November, 1930 following a period of comparative drought and hot weather, the mortality among the stocks of *Ctenopharyngodon idellus*—the grass fish—was remarkable. Although deaths are expected at this time, no such mortality had been known previously in Singapore and it has indeed been ascribed to the work of some devil.

All kinds of ponds were affected, but it was only *Ctenopharyngodon* which suffered. Estimations of oxygen and pH value were carried out in various affected ponds, at the same time, and although they varied, they were in no way abnormal. The food was unchanged; and the fish were receiving precisely the same treatment they had always received.

The factor common to all was the low temperature and it is suggested that this particular fish caught cold.

The fish first went off their feed and the next symptom was the horizontal attitude they assumed when swimming with the dorsal lobe of the tail out of the water. They were continually gasping for air and ultimately turned on their backs and died. The apparent illness lasts for about two days and it seems as if once stricken there is no recovery. The gills were pale and the gill filaments along the edges of the gills seemed to have decomposed. Internally, all the organs appeared to be normal except that the gall bladder was distended with gall of a normal colour and the kidney appeared to be inflamed and very soft. There was a watery blood discharge and the anus had a red inflamed appearance. The intestines were all empty, but the dead fish outwardly looked bright and no internal parasites could be found. The conclusion that these fish had caught cold is suggested by the fact that they always seek their food on the surface of the water, and it is thought that during the heavy downpours of cold rain they came in contact with an upper layer of chilly water which may have caused some affection of the gills or a derangement of their secretory and excretory organs.

It is well known that fish are sensitive to sudden changes of temperature and this is amplified by the fact that the greatest care must be taken when transferring them from one water to another.

Predatory fish such as 'aruan' (Ophiocephalus), 'keli' (Clarias), 'betok' (Anabas) are only dangerous among the small fish and must be cleared from

a pond before small carp are put in. All these predatory fish will, sooner or later, find their way into a pond, but provided that the carp are over six inches in length, there is not much danger unless an exceptionally large 'aruan' (Ophiocephalus) enters the pond. Clearing a pond may prove not only expensive, but often of great inconvenience where the only water supply is rain. The Chinese have a very effective and cheap method of poisoning the fish without draining off the pond. They brew an extract from pressed waste tea stalks which are imported into Singapore in the form of hard cakes resembling cattle cake. The cake is known in Chinese as Teh Chee Ko. The amount required depends on the size of the pond to be treated but taking the unit 100 feet x 50 feet x 3½ feet (deep) 200 lbs. is sufficient to produce a strong tea extract. Within 24 hours all the fish within the pond are killed. The pond should now be left for fourteen days by which time it will have resumed its former condition and will be fit for use again. The tea waste is extremely cheap usually being sold for about 1½ cents per pound.

Fish Ponds and Malaria.

The question of mosquito control in fish ponds in relation to malaria is an important problem and much research is needed before any definite conclusions can be advanced. The Chief Health Officer, Federated Malay States, reports that the following anopheline mosquitoes breed in fish ponds in the Kinta and Kuala Lumpur Districts:—*A. barbirostris, A. hyrcanus, A. leucosphyrus, A. rossi, A. sinensis.* This list omits the common malaria carriers *A. maculatus, A. ludlowei* and *A. umbrosus.* He further states that among the first mentioned group several are potential carriers of malaria and one at least has been found to be infected under natural conditions and it has been conclusively show that mosquitoes will deposit their eggs in any kind of water if they are deprived of their favourite habitat. This is a fair statement of the situation. The experience gained in Singapore is that the carp ponds, if under full cultivation, will not produce mosquitoes, but directly the pond goes out of cultivation mosquitoes appear.

When a pond goes out of cultivation, it assumes a more pleasant appearance than when it contains fish. The water soon becomes clear and acid and rooted pond-weeds appear. Previously it would be green or muddy, without rooted pond weed and distinctly alkaline—probably due to the organic 'pollution". Under these conditions it appears that mosquitoes may not lay their eggs, or that eggs will not develop in a polluted water, and this point should be clearly established during the investigation. The prior importance of health, particularly in relation to malaria, cannot be overlooked. On the other, the local production of a most important source of food of high value must be conserved.

There should be no objection to the industry being carried out in rural areas and it might be an excellent plan to cultivate mining holes which are at present producing mosquitoes and which cannot be drained. The Chief Health Officer, Federated Malay States, is of the opinion that carp farming cannot be carried on in Sanitary Board areas, or within a radius of half a mile of

METHOD OF NETTING CARP.

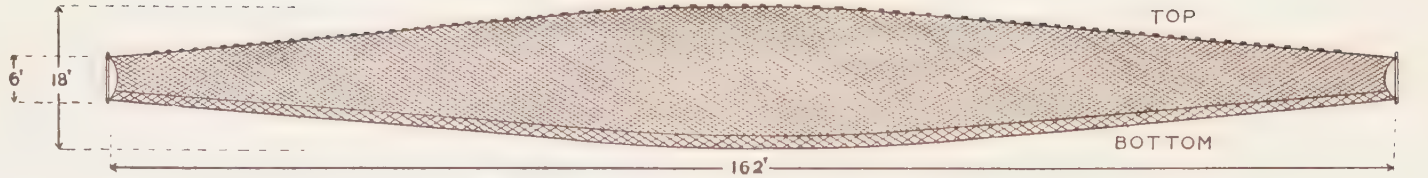


Fig I

FIG. I.
Fish net. The corks at top are made of "pulai" and the net is of one inch mesh. Attached to bottom of net is a strip of coarse 2 inch mesh net bounded by a heavy foot rope. This foot rope saves the finer mesh above.

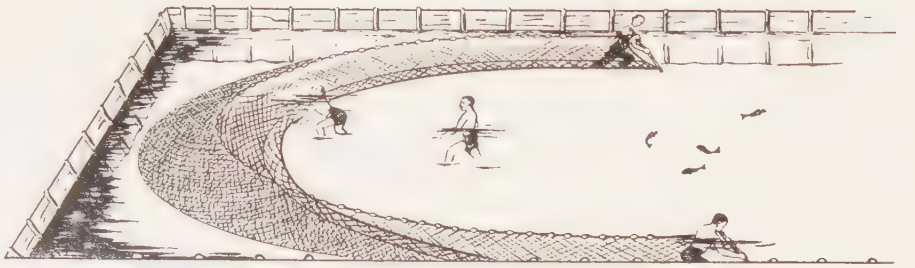


Fig II

FIG. II.
Hauling the net. The men in the centre not only drive the fish into the net, but free the foot rope from obstructions and take care that it keeps on the bottom.

FIG. III.
Hauling the catch. The men in the pond hold the foot rope together to prevent the escape of fish where the net lifts when leaving the bottom.

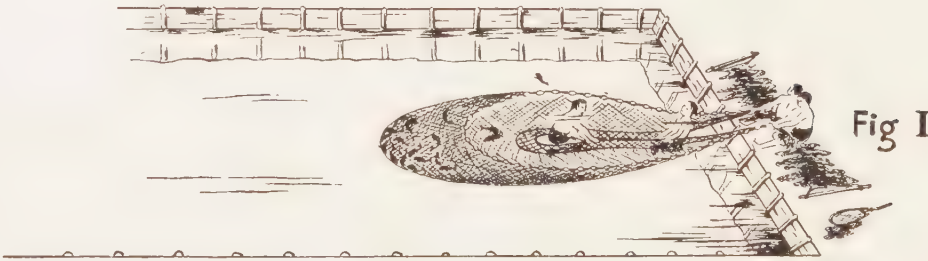


Fig III

K.P.CO.LTD.

such areas without danger to the inhabitants. This is quite reasonable until more is learnt about mosquitoes. There is always a danger of a careless cultivator allowing puddles to form near his ponds, and often a small pit is dug to receive fish for a temporary period.

In the interests of the industry, it is probably necessary to make regulations to ensure that the fish pond is being cultivated in a proper manner.

Costs.

It should be borne in mind that carp rearing in Malaya is carried on almost exclusively by Chinese small holders and costs in terms of money may be misleading. The main expenses in connection with this industry are direct labour charges, apart from the cost of the fish for stocking, planking to maintain the sides of the pond and a trifling amount for peanut cake.

If it is necessary to engage labour to dig a pond, 100 feet x 50 feet x 4 feet deep, this would cost to-day $250, plus say $100 for planking, making a total of $350. Such a pond would produce 300 kati (i.e. 400 lbs.) of fish per annum which would realise $75 (£8-15-0) at 25 cents per kati. This is a conservative estimate of cost of production and sale. Therefore, only those with sufficient capital can afford to wait for as long as 4 or 5 years before they recover their capital.

The Chinese immigrant as a rule has no capital. He therefore digs his pond in his spare time when not planting vegetables. Often neighbours will combine in making a pond and form a partnership, taking no payment for their labour, but sharing in any profits.

The Malayan Carp Ponds.

A conservative estimate based on figures supplied from the various States in Malaya shows that there are at least 200 acres of fish ponds in cultivation. It is noted that the present tendency is for the number of fish ponds to increase. Basing figures on the estimate of 400 lbs. of fish per 5,000 square feet of water at 25 cents per kati i.e. 7 pence per lb. approximately 300 tons of fish are produced annually, valued at approximately £20,000 sterling.

The industry is primarily suited to small holders. The farther they are away from the crowded areas the less likely they are to antagonise Anti-Malaria Boards.

Malays object to the fish mainly on aesthetic grounds and often because of the proximity of the pig pens to the ponds. They cultivate the Common Carp since this fish will grow in almost any pond. If Malays can be shown that neither human nor pig excreta are necessary for carp rearing it is believed that they could be induced to try the other kinds in addition.

Much valuable assistance in this work has been given from time to time by Prof. J. Rosedale of the Medical College, Dr. K. B. Williamson who is now engaged in anti-mosquito work in the Cameron Highlands, and Mr. E. J. H. Corner of the Botanic Gardens, to whom the author tenders his grateful acknowledgements.

OIL PALM FACTORY AT SERDANG.

BY

B. BUNTING,

Agriculturist,

AND

C. D. V. GEORGI,

Acting Agricultural Chemist.

Introductory.

In view of the importance of the oil palm as a plantation crop in Malaya considerable attention has been devoted by the Department of Agriculture to its cultivation at the Experimental Plantation, Serdang.

The area at present planted at the Experimental Plantation with this crop amounts to approximately 175 acres, while further extensions are contemplated.

An essential part of every oil palm estate is the factory for the preparation for export of the two products, palm oil and palm kernels. With such a comparatively large area under experimental cultivation sufficient fruit is available to warrant the installation of a large scale plant to study the various methods of treatment of the fruit under estate conditions. The factory recently established at Serdang serves the double purpose therefore of utilising the fruit harvested from the different experimental plots and of allowing various investigations to be carried out on the methods of manufacture.

Description of Plant.

The plant in the factory has been selected with a view to comparing the two systems at present in use for the extraction of palm oil, namely, the centrifugal system and the press system. Both a centrifugal extractor and a press have therefore been installed, necessary arrangements being made for either machine to be used with the remainder of the plant which is common to both systems.

The following is a detailed description of the plant at present installed :—

(1) Two mild steel sterilisers, each having a capacity of 5 cwts. of cleaned fruit.

(2) One mild steel elevator.

(3) One "Weston" type centrifugal extractor complete with digester, capacity 5 cwts. of fruit per charge.

(4) One hydraulic press, complete with stirring-kettle, capacity approximately 10 cwts. per hour.

(5) One hydraulic pump for press.

(6) One spiral screw conveyor for discharge of refuse from centrifuge or press.

(7) Three mild steel washing tanks, each with a capacity of approximately 250 gallons.
(8) One mild steel sludge tank having a capacity of approximately 120 gallons.
(9) One combined storage and washing tank for final purification of oil.
(10) One De Laval centrifugal separator, size No. 300, having a purifying capacity of 110 gallons of oil per hour.

The centrifugal extraction plant, comprising elevator, digester, centrifugal extractor and conveyor, was supplied by Messrs. Manlove, Alliott & Co. Ltd., Nottingham, and the press installation, comprising stirring-kettle, hydraulic press and pump, by Messrs. Gebr. Stork & Co., Amsterdam.

The necessary power plant consists of one Ransome's No. 16 loco-multitubular boiler and one No. 12 compound girder-frame steam engine. The boiler, which works at a pressure of 160 lbs. per square inch, is fitted with an extra large firebox to burn the waste fibre and shell from the factory. Both the boiler and engine were supplied by Messrs. Ransomes, Sims and Jefferies, Ipswich.

Methods of Working.

The following is a brief description of the present method of treatment of fruit in the factory :—

Collection of Fruit.—The fruit bunches after harvesting are taken to collecting sheds where they remain for 5 or 6 days to facilitate separation of fruit. Immediately after separation the cleaned fruit is transported to the factory for treatment the same day.

Steriliser.—On arrival at the factory the fruit is weighed and placed in the sterilisers in which it is treated with live steam for a period of one hour. The sterilised fruit is then transferred by means of an elevator to a hopper placed above the digester for subsequent treatment in either the centrifugal extractor or the press.

Centrifugal Extraction.—The fruit from the hopper is fed into a closed digester, fitted with revolving arms, in which it is treated for 25 minutes. The digester is steam-jacketed, while steam is also admitted to the body of the digester. A steam pressure of 45 lbs. per square inch is maintained in the jacket, but approximately only 5 lbs. per square inch is required inside, this amount being sufficient to assist in softening the walls of the oil cells and facilitating disintegration of the fruit. The time required to transfer a charge from the steriliser to the digester is approximately 5 minutes.

The mashed fruit is transferred by gravity to the centrifugal extractor in which it is treated for a period of 15 minutes. The normal speed of the extractor is 900 revolutions per minute and it is essential that this speed be maintained during the whole period of extraction. The centrifuge is fitted with a bottom discharge, which permits of easy removal of the pericarp residue and nuts to the spiral conveyor situated below.

It takes approximately 5 minutes to transfer the mashed fruit from the digester to the centrifugal extractor, a similar period being required to discharge the refuse into the conveyor. The centrifugal extractor is 42 inches in diameter and 20 inches deep and has a working capacity of approximately 5 cwts. per charge. Allowing for 10 charges per working day of 8 hours the capacity of this plant is therefore approximately 2½ tons of cleaned fruit per day.

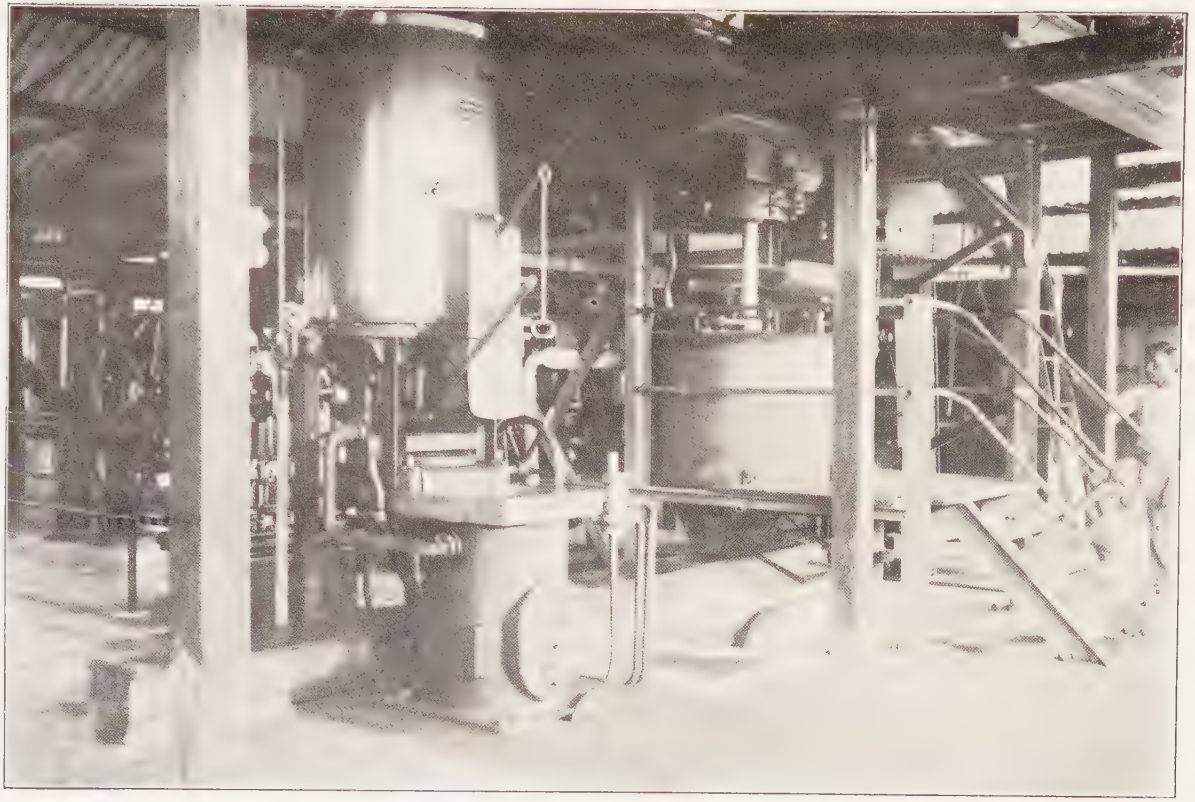
Hydraulic Pressing.—In the case of the press the sterilised fruit is conveyed into an open stirring-kettle provided with steam-jacket which may be submitted to a working pressure of 45 lbs. per square inch. The kettle has a capacity of 250 kilogrammes (approximately 550 lbs.) of fruit. The digestion of the fruit is effected by means of steel stirring arms fixed to a vertical shaft revolving at about 30 revolutions per minute. The fruit is digested for a period of 20 minutes, after which pressing is commenced. The press, which is of a closed cage type of special design and is also steam-jacketed, is situated below the stirring-kettle, charging being effected by means of a hand-operated shutter fixed at the base of the kettle. The amount of mashed fruit removed from the kettle when filling the press is replaced by an equivalent amount of sterilised fruit so that the level of mash in the digester remains constant. The mashed fruit is packed in layers of about 4 to 5 inches deep, each layer being separated by a steel plate, the function of which is to distribute the pressure evenly during the operation of pressing and to facilitate the discharge of the press cake. The capacity of the press is 60 kilogrammes (approximately 132 lbs.).

The press is operated by means of a hydraulic pump of special design. This pump contains three plungers working at varying pressures as follows :—

(a)	low pressure,	75 kilogrammes per square centimetre.
(b)	medium pressure,	175 kilogrammes per square centimetre.
(c)	high pressure,	350 kilogrammes per square centimetre.

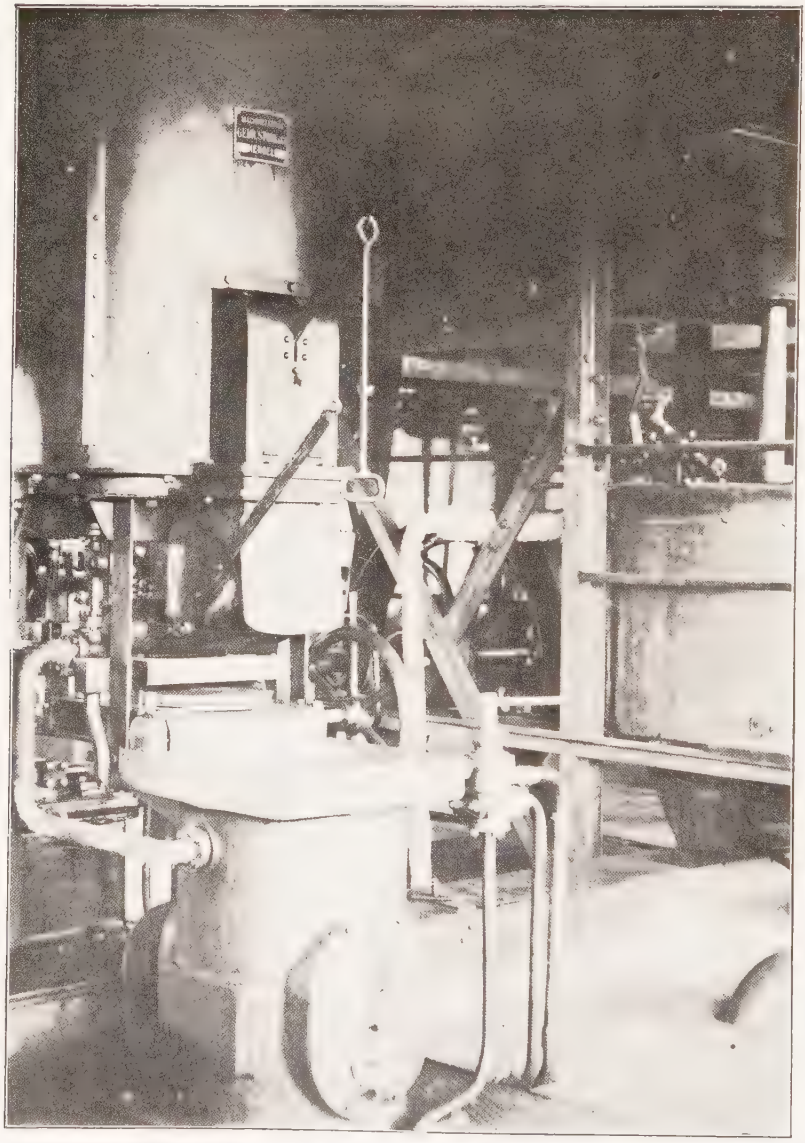
When working the pump the change from one pressure to another is effected automatically as the pressure exceeds the maximum limit. In the case of the high pressure the pump is capable of developing a pressure of 450 kilogrammes per square centimetre, but a working pressure of only 350 kilogrammes per square centimetre is maintained. The liquid used in the pump may be either lubricating oil or an emulsion of oil and water to which a small amount of good quality neutral soap is added.

The press is capable of rapid working, but this depends entirely on the skill of the operator. Allowing one minute for filling, four minutes for pressing and one minute for discharging, 10 charges, equivalent to approximately 12 cwts. of fruit, can be operated per hour. It is stated, however, that a skilled operator is capable of maintaining a regular output of 12 to 14 charges per hour. Such a rate must of necessity reduce the period of actual pressing and unless the residue is being subjected to further treatment for



Oil Palm Factory at Serdang.

General View showing both Press and Centrifugal Extractors.



Oil Palm Factory at Serdang.

Stork Hydraulic Press showing Stirring-kettle above.

oil recovery it would appear advisable in the case of single treatment of fruit to work the press at a slower rate in order to obtain an increased recovery of oil.

Oil Receiving Tank.—The crude oil and water discharged from either the centrifuge or the press passes into a cylindrical tank having a capactiy of 75 gallons. The tank can be closed and steam admitted by means of a valve; this has the effect of forcing the oil from the tank along the pipe leading to the washing tanks.

Washing of Oil.—The washing tank having been filled to the necessary height the mixture of crude oil and water is boiled with live steam for two hours. The contents of the tank are then allowed to settle for about 18 hours, after which the water is run off from the bottom of the tank until oil appears at the test cock, situated a few inches above the base of the tank. The washed oil is run off through the main cock fixed in the side of the tank into another cylindrical tank situated just below ground level. The latter is similar in construction to the oil receiving tank described above, the washed oil being forced by steam to a storage tank situated above the De Laval centrifugal separator.

In the case of crude oil from the press it has been found necessary to add approximately half its volume of water in order to ensure a satisfactory separation of the oil, sludge and water after boiling.

Sludge Treatment.—The residue from the washing tank is transferred to a smaller tank of similar design in which the mixture of oil, sludge and water is treated with live steam for a period of two hours and then allowed to settle for approximately 18 hours. The separation of the water and oil is effected in a similar manner to that employed in the washing tank, the oil being transferred to the storage tank for treatment in the De Laval purifier. The residue in the tank is afterwards thrown away, since experience has shown the further recovery of oil to be impracticable.

De Laval Separator.—The washed oil from the storage tank fitted above the centrifugal separator is first heated to a temperature of approximately 75°C. and allowed to flow by gravity into the base of a further washing tank, which is also filled with hot water of the same temperature. The oil, being lighter than water, rises to the surface and is washed in transit. When the oil layer is of sufficient depth the oil overflows through a pipe leading to the De Laval separator in which the oil and water are separated, the two liquids being discharged through different outlets. The small quantity of matter in suspension in the oil is retained in the bowl of the separator. The purified oil is then passed over a zinc tray in order to reduce the temperature before being delivered into barrels through an automatic filler.

Shipment of Oil.—The oil is at present packed in barrels made of Californian fir, the barrels being assembled on the Plantation. A finished barrel weighs about 60 lbs. and has a capacity of approximately 40 gallons,

which is equivalent to approximately 375 lbs. of palm oil per barrel. Six barrels are therefore required for each ton of oil.

Extension of Plant.

As is well known, the latest factory practice on estates is to sterilise the fruit bunches under pressure, the fruit being separated subsequently by means of mechanical strippers. No provision has yet been made for the installation of such a plant in view of the fact that the results of many of the field experiments at present being carried out are based on records of the amount of cleaned fruit on account of the large variation found in the composition of bunches from young palms. The installation of a bunch steriliser will be considered, however, at a later date when with more mature palms there will be less variation in the composition of the bunches and it will be possible to rely upon weights of bunches for purposes of record.

Further, no arrangements have yet been made for the treatment of the residue of pericarp and nuts from the centrifuge or press. This matter is, however, receiving consideration and a screen for separating the nuts from the fibrous residue, a nut-cracker and a dry separator for dealing with the cracked nuts will be installed later to complete the plant.

In view of the present unsatisfactory prices prevailing for palm oil it is not proposed to consider the installation of either a heavier type press or a solvent extraction plant for the further treatment of the fibrous residue.

Proposed Experimental Work.

The following is a summary of the proposed experiments which it is intended to carry out in connection with the treatment of the fruit in the factory :—

(1) Sterilisation of fruit for varying periods having regard to the acidity of the resultant oil.

(2) Centrifuging of fruit under varying conditions with the object of determining those required for the maximum recovery of oil.

(3) Pressing of fruit for varying intervals with a view to ascertaining the optimum period for obtaining the maximum recovery of oil.

(4) To determine the extent to which the recovery of oil is possible by further treatment of centrifuged pericarp residue in the press.

(5) Losses of oil in purification of crude oil from both centrifuge and press under varying conditions of treatment during the washing process.

(6) Comparison of the relative efficiencies of the centrifuge and press.

(7) Institution of methods of factory control for the most economical treatment of fruit in the factory.

General View of Palm Oil Purification Plant

at the Serdang Experimental Factory.

View of Serdang Experimental Oil Palm Factory.

General.

At present the yield of fruit from the area under cultivation is only sufficient to warrant the factory working two days per week, but with the greater productivity of the palms on account of increasing age and the extension of the area the factory will gradually have to be run more frequently to deal with an increased output.

In this connection it may be interest to note that the weights of fruit treated and the amounts of oil recovered during the last four months have been as follows :—

Month	Weight of Fruit lbs.	Weight of Oil lbs.	Percentage Recovery.
April	40,984	11,123	27.1
May	38,859	10,465	26.9
June	31,417	8,897	28.3
July	36,928	10,297	27.9

The comparatively high figures obtained for percentage recovery are due partly to the absence of trash and undeveloped fruits and partly to the loss of moisture during storage in the collecting sheds.

With regard to the quality of oil the average acidity, calculated as palmitic acid, during the above period was approximately 4.5 per cent. The average moisture content was 0.31 per cent. while the matter in suspension has always been less than 0.01 per cent.

The slight increase in the figure for the acidity of the oil, compared with that for normal estate practice, can be attributed to the bruised condition of that proportion of the fruit which before treatment in the factory is required for compiling records of yields in connection with various experiments.

GAMBIER AS A CATCH-CROP WITH OIL PALM.

BY

C. D. V. GEORGI,

Acting Agricultural Chemist,

AND

E. A. CURTLER,

Assistant Agriculturist.

Introductory.

The present paper summarises the results of an investigation carried out at the Experimental Plantation, Serdang regarding the cultivation of gambier as a catch-crop with oil palm, a preliminary account of which was published in this Journal for November, 1929.

Although it is not proposed to describe again the lay-out of the plot, the methods both of harvesting the fresh shoots and of the extraction of the gambier a brief account of the whole experiment will be given since the work has now been completed.

Summary of Experimental Work.

The area of the plot comprised one acre, the oil palms being planted 28 feet x 28 feet triangular.

The gambier seedlings were planted in November, 1925, some six months after the oil palms had been established.

Three rows of gambier were planted in the avenues between the palms, the approximate width of an avenue being 24 feet. The rows of gambier were spaced 6 feet apart with the same distance between the rows.

Harvesting commenced towards the end of October 1926, that is approximately one year after planting in the field.

In February, 1927 it was decided to utilise the plot for the additional purpose of ascertaining the variations in yield between harvesting after different periods, those chosen being 3 months, 4 months and 6 months respectively.

In February, 1928 the two outer rows of gambier plants from each group in the plot were removed owing to the development of the oil palms being obstructed, while in February, 1930 it was decided for the same reason to cut out the remaining row, the experiment terminating after a period of nearly four and a half years.

Periodic Harvesting of Gambier.

The following table, Table I, gives the details of the annual yields of the fresh prunings, having regard also to the periodic harvesting of the plants.

TABLE I.

Annual Yields of Fresh Gambier Prunings.

Period between harvesting. months.	Annual yields from groups of plants. No. of plants.	Annual yields from groups of plants. Weight of fresh prunings. lbs.	Average yield of fresh prunings per plant. lbs.	
A. First year, Feb. 1927—Feb. 1928.				
3 months	271	4538	16.7	
4 months	260	4271	16.4	15.9
6 months	259	3800	14.7	
B. Second year, Feb. 1928—Feb. 1929.				
3 months	90	1425	15.8	
4 months	87	1561	17.9	17.4
6 months	84	1563	18.6	
C. Third year, Feb. 1929—Feb. 1930.				
3 months	90	895	9.9	
4 months	86	1065	12.4	11.5
6 months	84	1037	12.3	

The slight increase in the average yield per plant during the second year may be due to the increased vigour of the remaining row of plants as a result of the removal of the two outer rows. There is, however, a marked decrease in this figure during the third year of the experiment.

Yield of Gambier.

In connection with the periodic harvesting of the crop the following table, Table II, shows the figures for the moisture-free gambier content of the fresh cuttings. In order to make the table as concise as possible only the averages for the different years are given.

TABLE II.

Average Moisture-free Gambier Content of Fresh Prunings with Varying Periods of Harvesting.

Period of Experiment.	3 months	4 months	6 months
	per cent.	per cent.	per cent.
A. First year, Feb. 1927—Feb. 1928.	6.7	7.0	6.7
B. Second year, Feb. 1928—Feb. 1929.	6.4	7.3	6.3
C. Third year, Feb. 1929—Feb. 1930.	6.7	7.9	6.0

The results indicate an optimum period of cutting at intervals of 4 months, thereby confirming the figures published previously.

A further table, Table III, shows the figures for the calculated yields of moisture-free gambier for the three years of the experiment during which periodic harvesting was carried out.

TABLE III.

Calculated Annual Yields of Moisture-free Gambier.

Period of harvesting months.	Feb. 1927 to Feb. 1928. lbs.	Feb. 1928. to Feb. 1929 lbs.	Feb. 1929 to Feb. 1930 lbs.	Total lbs.
3	308.2	90.9	60.0	459.1
4	299.1	114.8	84.1	498.0
6	255.1	97.1	62.2	414.4

In view of the fact that such a large proportion of the gambier plants was removed at the end of the first year, compare Table I, the results, except in the case of the second and third years, are not comparable. The diminution in the yield of gambier during the third year compared with that for the second year is however marked.

In this connection also it may be interesting to record that the total calculated yields of moisture-free gambier from the various series of groups during the whole experiment would be as follows :—

Period of harvesting. months.	Calculated yield of moisture-free gambier. lbs.
3	557.4
4	594.4
6	509.4
Total	1661.2 lbs.

Remarks and Conclusions.

Although the figures for the weights of the fresh prunings during the separate years of the periodic harvesting experiment show little significant difference, those for the analysis of the extracts clearly indicate an optimum period of cutting at intervals of about 4 months.

With regard to the method of extraction it is recognised that the period of treatment would be insufficient to permit of complete extraction of all soluble matter. As pointed out previously, however, such a method was adopted since it was desired to follow as far as possible the practice that would in all probability be adopted on an oil palm estate merely growing the gambier as a catch- crop.

The calculated total yield of moisture-free gambier from the plot during the whole experiment amounted to 1661 lbs. (approximately 12.5 piculs). Assuming that all the gambier had been harvested at the optimum period it can be calculated that the yield of moisture-free gambier over a period of three and a half years would be approximately 13.5 piculs per acre, of which approximately 66 per cent. would be recovered during the first 18 months of harvesting, the amounts for the remaining two years being 19 per cent. and 15 per cent. respectively.

The average moisture content of commercial bale gambier is approximately 50 per cent., so that for the purposes of calculating the yield of the commercial product the above figures should be doubled. This would increase the total yield for the whole period to 27 piculs per acre, of which approximately 18 piculs would be recovered during the first 18 months of harvesting, but only 5 piculs and 4 piculs respectively during the remaining two years.

The comparatively low yields of gambier obtained during the last two years of the experiment are due to the removal of such a large proportion of the original plants and it is extremely doubtful whether gambier planted under such conditions would prove remunerative.

The results show that if the maximum return is to be expected from the gambier it should be planted a year ahead of the oil palm. In such a case the possibility of soil erosion would have to be considered and the establishing of this catch-crop at such an early stage of development of the oil palm estate would have to be restricted to flat areas. Experience has also shown it to be necessary to keep the gambier plants clear of the palms at all stages in view of their tendency to smother the palms and obstruct their development.

Reviews.

Report of the Committee on Soil Erosion.

Ceylon Sessional Paper III—1931, 54 pp. 18 figs. and index. Government Record Office, Colombo. Price Rs. 1.10.

When tropical agriculture was conducted on a comparatively small scale, the question of damage by soil erosion was of only local importance. Particular small areas might be damaged in this way, but land was relatively cheap and the financial returns on a sufficiently generous scale, so that little attention was directed to the loss of capital incurred by reason of soil erosion.

The subject gained a new significance during the era when large areas of land were developed for such crops as rubber, tea and coconuts. The damage then became not merely confined to the particular estate, but was so general and of such a magnitude that the course and navigability of rivers was affected and widespread damage by flood was consequent on the silting up of rivers.

This is the experience not only of Ceylon, but of all tropical countries with a heavy rainfall.

Unfortunately, it was not until the damage caused by this denudation had continued for some years that the gravity of the situation was fully appreciated and somewhat belated steps were taken to minimise future losses by this cause and consideration was given to the problem of reconditioning land which had suffered in this respect.

The report before us is divided into five chapters and contains four appendices. It states the nature and extent of the damage by soil erosion particularly as it affects Ceylon. The problem in Ceylon is closely examined, the damage occasioned by this cause carefully set out and some account given of the steps taken in that Colony to preserve the soil from future damage.

The attitude of the agriculturists towards soil erosion, the views of the Committee and its recommendations are the subjects of sections and are dealt with in some detail.

Emphasis is laid on the fact that soil erosion is caused primarily by the free movement of water on the surface of the ground. In view of the fact that "doubling the velocity of water increases its transporting power sixty-four times", the key to the problem of soil erosion is the prevention of this movement of surface water. Consequently, the old idea that drains should be designed to take water off the land as quickly as possible is obsolete.

The Committee strongly condemns the practice of clean clearing and gives particular attention to cover crops and their effects. It would appear that there is a distinct prejudice against a cover crop with tea, a crop which would especially require some such protection, as it is frequently planted on steep slopes. The attitude of the agriculturist in Ceylon is stated to be "moderate rather than advanced, and it may be repeated that the impression was gained again and again that many planters were prepared to modify their views and

take further action if they were persuaded that modification and action were desirable". But the Report states elsewhere that the Committee were appalled by the actual denudation which is going on apparently unchecked and they could but draw the conclusion that many did not realise the gravity of the situation. They further found that in general the treatment of new clearings left much to be desired, the steps taken to prevent erosion being either inadequate or were adopted too late to be of full value.

Amongst the more important recommendations of the Committee are to be noted the universal use of cover crops; further research work; education and propaganda by lectures and through school gardens; and certain precautions to be observed in alienating Crown land for development. An appointment of an extra staff officer on soil erosion is recommended, besides facilities to enable the present field officers of the Department of Agriculture to keep abreast of all developments of the subject.

The Report leaves one with an impression that Ceylon planting politics are less advanced on this subject than are Malayan. It may be that this is erroneous and is caused by the fact that the Committee was naturally impressed by the damage done and the desire to see an improvement effected. The Report will focus attention on a serious problem which applies to Malaya as well as Ceylon. The Ceylon Committee appears confident that sufficient improvements can be brought about if their recommendations are put into practice, for they are adverse to the introduction of legislation to effect their purpose. But they add, "that after educative methods have been tried for a limited period, or, if the present depression continues for seven years, the subject should be brought up for review on the understanding that, if conditions are still unsatisfactory, compulsion by means of legislation should be further considered".

D. H. G.

Administration Report of the Royal Irrigation Department of Siam 1914-1926

219 pp. Illustrations and maps. Bangkok Times Press Ltd., 1927.

In view of the desirability of extending and improving the rice-growing areas in Malaya, the above report, although published five years ago, is of increasing significance. It provides a record of the successful development of rice-cultivation in Siam which should be of great value in the development of similar schemes elsewhere.

This report opens with an introductory note explanatory of the events which led to the re-establishment of the Royal Irrigation Department.

The rainfall in the main rice producing districts in Siam is only about 41½ inches per annum whereas the rice crop is reckoned to require some 72 inches in its growing season (6 months). In years of good rainfall the de-

ficiency is made up by the rivers spilling over the banks, but in years of scanty rainfall, or rainfall coming at the wrong time, the rivers, unassisted, do not rise sufficiently to provide for satisfactory inundation and the crops suffer proportionately.

The problem of stabilising, increasing and improving rice production in Siam has always been given much consideration though the first tangible attempt to control irrigation for the crop was made only forty years ago by the formation of the Siam Canal, Lands and Irrigation Company.

This Company obtained a large concession (Rangsit) of land, dug a series of canals and constructed certain locks and sluices with the object of conserving available water supplies for use in times of scarcity, rather than to provide irrigation in the true sense. Briefly, these canals, completed in 1896, were simply inundation canals merely serving the purpose of intercommunication, and on silting up, many became useless. The Concession brought under cultivation some 350,000 acres of excellent land but only 40 per cent. of the area matured crops each year so that the high hopes of increased productivity were not realised. The inherent defects of the scheme were soon evident and the Concession lapsed to Government in 1915 and was taken over by the Royal Irrigation Department.

In 1899, the Minister of Agriculture, after a tour of inspection of the Rangsit Concession, suggested the appointment of an hydraulic engineer as an adviser to that Ministry. His late Majesty King Rama V graciously approved the proposals, and eventually Mr. J. Homan van der Heide, of the Netherlands East Indies, was appointed first Director-General of the Royal Irrigation Department. The series of locks and sluices projected by Mr. van der Heide added materially to the prosperity of the southern portions of the central plain, but financial exigencies prevented the materialisation of any of his main projects before he left Siam in 1909.

Two very dry years 1909—1911 compelled the Government to reconsider measures for improving the water control for the rice crop, and consequently a Commission was appointed to devise the best means towards this end, and on that Commission's report the Minister of Lands and Agriculture was instructed to prepare irrigation schemes.

With this object, Mr. Ward (now Sir Thomas), together with a Staff of his own selection, was recruited from the Indian Irrigation Service to solve the problem in Siam. Thanks to the mass of preliminary data available through the efforts of Mr. van der Heide, Mr. Ward completed a series of projects for the irrigation of almost the whole central plain of Siam within 18 months and then returned to India, while his chief assistant, Mr. R. C. R. Wilson, was appointed Director of the resuscitated Royal Irrigation Department.

The results of Sir Thomas Ward's investigations were published in four volumes, and his report showed that he had arrived at the same conclusion as Mr. van der Heide, namely that the possibilities of scientific irrigation in Siam were very good and that great benefits should accrue therefrom.

He was of opinion that irrigation developments in the country should be gradual and sure without going ahead of natural demand, and experience to date has justified his opinion. His idea of development embraced five distinct projects which would eventually be linked up into one comprehensive scheme protecting the whole of the central plain and mainly dependent on the waters of the Menam Chao Phya for its supply.

The Government of Siam decided to begin work on the Prasak South Canal in 1915 and immediately set about expropriating the necessary land for the head work and main canal and the selection of the site for the head works. Suitable compact limestone for the construction of the barrage was located conveniently and the Prasak river itself yielded sand suitable for cement mixing to produce a satisfactory mortar. The use of machinery, on the grounds of economy, was advocated, and two drag line excavators of American design were ordered, each being capable of digging 4½ cubic metres of earth at one cut and having a swinging radius of 28 metres. These two excavators were so successful that two more were ordered. Other important machinery included a suction cutter dredge, a large steam shovel (used exclusively for digging the pit for the construction of the barrage and head works), a small steam shovel, locomotives, steam hauling winch, stone crushing plants, tip waggons, light rails, concrete mixers, pile drivers, locomotive crane, and general contractor's plant. The head works of the canal system, in addition to the necessary excavations and the construction of a dam to close the old channel of the river, consist of a barrage of six spans (each of 12.5 metres), a head regulator, a lock to pass boats, a lock leading from the river to the canal and bridges for traffic across the new channels. The Report (with photographs) describes each of these structures in detail and gives the quantities of materials used, details relating to the working of the various machines and details of the costs (over £1,180,000) of the works which were completed (in 1924) after 6½ years. The project affected directly 240,000 acres and indirectly affected the whole of the Rangsit Concession and was capable of expansion to a much larger area by the extension of the distributaries as required.

Further sections of the report deal with the progress of other irrigation and drainage works embracing six separate schemes estimated to cost over £2,350,000 towards which the Ministry of Finance recommended an expenditure of £224,000 per annum commencing in 1923. These reports of progress indicate the importance which the Siam Government attaches to the problems of irrigation as affecting the main food crop and wealth-producing asset of the country and might well be imitated in Malaya on a proportionate scale.

The report contains weather, water supply and meteorological data which are of considerable interest, and a chart shows that the production of padi per acre follows fairly closely the maximum height of the river on the Ayuthia gauge and that the total production of rice tends to increase annually. The concluding sections of the report deal with works carried out in the central workshops,

and various lists of machinery, stores, dredging plant, buildings, etc. The report is of interest to the agriculturist, the hydraulic engineer and the administrator and forms a compendium of very useful information especially for irrigation engineers.

H. W. J.

SISAL UND ANDERE AGAVEFASERN.

(Sisal and other Agave fibres).

BY

Dr. Fr. Tobler.

120 pp., 44 illustrations. Deutscher Auslandverlag Walter Bangert. Berlin, 1931.

The author, although not claiming to be a planter, is of opinion that the practical man may find useful these personal experiences in East Africa as well as in Yucatan, Mexico.

Botanical information of the sisal plant, its distribution and export statistics form the subject matter of the first chapter. The second chapter explains and compares the difference in the quality of fibre from various species and countries and from plants of a common species at different ages.

Subsequent chapters treat with the subjects of cultivation, estate practice; cropping, fibre extraction, cleaning, curing and marketing; spinning; uses of the fibre, fibre products and literature.

Particular interest attaches to the chapter which describes the method of selecting and collecting the leaves and of the machinery used in the various processes. This section also gives a brief summary of the gradual development of the methods of mechanical treatment with a comparison of the merits and demerits of the various types of machinery. Special attention is given to the causes of subsequent discoloration of the fibre and to the means for its prevention. Utilization of the waste in the manufacture of by-products is described and further possibilities are discussed.

For those familiar with the German language (the Roman character is employed) this little book will prove of great interest. The text is assisted by the many excellent illustrations which give a comprehensive idea of the botanical features of the plant, estate conditions and practice, mechanical and other procedure, and machinery.

L. A. J. R.

Miscellaneous Articles.

THE EIGHTH MALAYAN EXHIBITION.

The eighth Malayan Exhibition, organised by the Malayan Agri-Horticultural Association was held at Kuala Lumpur on the first three days of August 1931.

The weather on the first two days was fair and 21,000 people visited the Exhibition. On the final day, however, rain fell steadily during most of the day and seriously effected the attendance. The official return of attendance for the duration of the Exhibition is 24,139.

The Exhibition was opened by His Excellency the Governor and High Commissioner, Sir Cecil Clementi, G.C.M.G. The ceremony was also graced by the presence among others of His Highness The Sultan of Selangor and His Highness The Yang de Pertuan Besar of Negri Sembilan.

In his speech, His Excellency drew particular attention to the value of some of the minor crops of Malaya and of the possibilities that existed for developing their production. In addition he gave his views on the recommendations contained in the recent Report of the Rice Committee and stated that while action had already been taken to put some of the recommendations into practice others required his further consideration especially those that would entail large financial provision.

The Agricultural Show was divided into a number of sections, each of which was managed by a section Chairman assisted in some cases by a sub-committee. The sections were :—Vegetables, Fruits, Oils and Fats, Rubber, Cereals, Fibres, Preserved Fruits and Confectionary, Poultry, Pigs, Cats, Horticulture. The non-agricultural sections were :—Village Industries, Weaving and Needlecraft, Malay Schools, Art and Photography, and Trades.

The following institutions and Government Departments staged special exhibits :—Department of Agriculture, Rubber Research Institute of Malaya, Fisheries Department, Public Health Education and the Town Planning Department, while the Co-operative Societies Department with other Departments gave nightly displays of educative cinema films. The Rural Lecture Caravan, organised by the Departments of Agriculture and Co-operation with the Rubber Research Institute, was on view.

Space forbids anything but a cursory review of the exhibits in the numerous sections. The exhibits in the competitive sections were perhaps fewer than usual, but greater care had been exercised in their display. In particular, care had been taken to obtain stronger competition in the more important of Malaya's minor agricultural industries. The exhibits of canned pineapple, for instance, formed the most representative display yet seen at these Exhibitions, while the sample of palm oil from Elmina Estate, which won the Governor's cup, was stated by the Judge to be the finest sample analysed by him and fully equal to that produced commercially in any part of the world.

The Cereals Section contained a large number of samples of padi and rice drawn from most of the padi-growing districts of Malaya. An increasing number of samples originating from selected seed derived from the Government

Padi Stations is seen each year at these Exhibitions. The section is a centre of interest for the more critical Malays who may be seen examining the prize-winning samples for comparison with their own non-successful exhibits.

The fruit exhibits were rather disappointing. It is doubtful whether the Exhibition offers any great inducement towards the cultivation of better fruit. It is certain that the more attractive exhibits are purchased for seed purposes—His Highness the Sultan of Selangor was observed to set an example in this respect—but the quantity so utilised is little, while the need of improvement in this respect is great. It is hoped that on future occasions an attempt will be made to offer good stock for sale and to demonstrate the methods advocated towards the propagation of improved fruit.

The Vegetable Section was more representative of the best in the country, some of the Chinese exhibits calling for particular attention.

A special feature of the exhibits staged by the Rubber Research Institute was a large working model of the new Cascade sheeting battery and model tanks and other factory appliances to complete the equipment of a model miniature sheeting factory.

The Village Industries and the School Industries Sections commanded considerable attention. The exhibits were very numerous and sales were most encouraging. There is still a tendency amongst villagers to spend considerable time on making articles that have little or no utility, but it is noted that at each successive exhibition greater regard is given to the production of useful articles.

The section also included Malacca and Port Dickson basket work, Brunei silverware and work from the Kuala Kangsar Art School. A small section was also devoted to work from the Decrepit Asylum and was in charge of three blind inmates.

The School Industries section deserves special praise. The basket work was decidedly good and sold readily, while the special display from a Johore school, which included working models and carpentry was of great interest.

The Pig Show was the largest and most instructive yet staged at these series of Exhibitions. In addition to pure bred and cross bred pigs from the Government Experimental Plantation, Serdang, which were not for competition, other exhibitors shewed pure bred animals, some of which were not competing for prizes. In comparison, many of the local breed of pigs appeared poor specimens and thus provided a valuable object lesson on the possibilities of improvement of this important local industry.

A similar object lesson was provided in the poultry section. Sales were good, from which can be inferred that poultry keepers are becoming increasingly alive to the importance of introducing better strains in their runs.

An effective display was made in the Horticultural Show, which by reason of transport difficulties is practically confined to exhibits from around Kuala Lumpur.

The trade stands were on a less lavish scale than usual and were fewer

in number, but most of the big firms were present and attractively demonstrated the services they had to offer to local agriculture. The prominence, for the first time, of firms selling fertilisers was noticeable and it was also observed that the native agriculturist—in particular, the Chinese market gardener—was interested in these products as he is becoming more fully alive to the possibilities of employment of artificial fertilisers in his vegetable garden.

An inovation this year was the Fisheries Exhibit, staged by the Fisheries Department. The Department devoted most of its space to exhibits designed to encourage the development of fresh-water fisheries in Malaya. The article which appears in another part of this number of *The Malayan Agricutural Journal* will give some idea of the importance of this subject and the scope it offers for display at the Exhibition.

The work of the Health Department was adequately demonstrated in the Health Pavilion, where full use was made of models to illustrate the measures which are recommended to ensure the health in the home and on estates. The Infant Welfare section of this exhibit daily attracted a large crowd who could hardly fail to be impressed by the numerous exhibits and the recommendations that were rendered obvious by the excellence of the models.

Considering the Malayan Exhibition as a whole, one realises with satisfaction that the various workers concerned had this year given greater attention to improving the method of display and in demonstrating by means of models, the lessons they wished to drive home.

The Malayan Agri-Horticultural Association, by means of paying a certain number of railway fares, ensured that representative Malays from all parts of the country should see the Exhibition to enable the propaganda work of this event to be carried back to the more remote villages in the country. This, though perhaps a considerable drain on the resources of the Association, is an excellent system as it results in the certain dissemination of knowledge gained at the Exhibition over practically the whole of Malaya.

RUBBER AT THE MALAYAN EXHIBITION.

BY

B. J. EATON, O.B.E.,

Director, Rubber Research Institute of Malaya.

Rubber Section

The Malayan Agri-Horticultural Exhibition 1931.

In spite of the short period available for organisation and the present slump conditions in the industry, the Rubber Section of the Malayan Exhibition 1931 may be described as a success both in relation to the competitive exhibits and the educative and propaganda exhibits staged by the Rubber Research Institute.

A majority of the members of the Committee of the Rubber Section was at first opposed to the idea of any competitive exhibits from estates, but at the request of the Chairman decided to waive their objection provided the Chairman obtained definite promises of not less than 75 exhibits.

The Chairman circularised about 2,000 estates, including both European and Asiatic properties and obtained promise and support from 60 estates, together with one exhibit of locally manufactured rubber articles.

In addition, exhibits of smoked and air-dried sheets from small holders and an excellent collection of smoked sheets prepared by members of Co-operative Societies were received.

Although the total number of exhibits from large estates was disappointingly small, the response was better than was anticipated.

The exhibits from large estates included 50 samples of smoked sheet which were almost all of excellent quality, while many of the small holders' exhibits of smoked sheet were equally good.

Sole crepe was unfortunately conspicuous by its absence, while only two samples of pale crepe and 13 samples of lower grade crepes were exhibited.

Prizes were awarded by the judges as follows:—

	Smoked Sheet	*Pale Crepe.*	*Compo Crepe.*	*Scrap Crepe.*
1st Prize.	Sungei Tua Estate	F.M.S. Rubber Co., Kajang	Bungsar Est. (Socfin Ltd.)	Bungsar Est. (Socfin Ltd.)
2nd Prize.	Labu Estate	Changkat Salak Estate	Bujong Est.	
3rd Prize.	Nagalelai Estate		F.M.S. Rubber Co., Kajang	
Highly commended	Sungei Rambai			

It should be mentioned that all exhibits were selected at random from estates by Agricultural Officers and planters who were good enough to offer their services for this work, so that all exhibits were genuine commercial samples and not specially prepared for the Exhibition.

Only one firm, Messrs. Tan Kah Kee & Co., sent exhibits for competition in the class for locally manufactured rubber articles. The collection of articles from this firm was very representative and attractive and was awarded the first prize.

The attractive character, particularly of the footwear, combined with the low price of the articles shows clearly why this firm is able to compete so successfully with European and American rubber manufacturers.

A very attractive range of Cressonite rubber flooring and wall tiles was also presented to the Rubber Research Institute for exhibition by the Singapore Rubber Works. These tiles which are manufactured under the Cresson patents consist of a thin rubber layer of various attractive designs on an asbestos-cement composition and can be laid in the same manner as concrete tiles.

If these tiles can be manufactured at a competitive price they should find a rapid and extended use in all buildings. In addition specimens of Cresson Roadway blocks were exhibited, including one block which was laid in 1922 outside the Singapore Harbour Works and removed in 1928. The rubber cap on this block shows little sign of wear after 6 years' heavy service and only slight surface "cracks" caused by the effect of strong sunlight. An experimental piece of roadway with these blocks has also been laid down in London.

Mention might also be made here of the Gaisman rubber capped roadway blocks exhibited in the Trades Section by Harrisons, Barker & Co. Ltd.

The Rubber Section is also indebted to the Dunlop Rubber Company for the loan of a show case containing a collection of rubber articles manufactured by this well known British firm.

The articles of special interest in this collection were the sponge rubber seat of cars, rubber bicycle seats, a rubber truncheon for policemen, and a rubber headed mallet for fitters. An exhibit showing the various constituents used in tyre manufacture was also instructive.

Air-Dried Sheet.

Owing to the fact that the present market demand for air-dried sheet is limited, it was decided not to include this in a class for competition.

The Rubber Section and the Rubber Research Institue are, however, indebted to the Socfin Co. Ltd., Selangor, and Kamuning Estate, Perak, for excellent exhibits of this grade, which represent commercial samples exported from Malaya.

Kirby Estate (Labu) also exhibited (not for competition) an excellent range of coloured sole crepes and ordinary sole crepe.

An interesting sample of crepe prepared from air-dried sheet clippings was also exhibited by the Socfin Co. Ltd.

Rubber Research Institute Exhibits.

A comprehensive series of exhibits were staged by the various Divisions of the Rubber Research Institute. The main object of these exhibits was

educative and to illustrate some of the principal activities of the Institute in relation to improvements in estate practice.

Chemical Section.

Special mention must be made of the miniature working model illustrating a proposed ideal lay-out for a central sheeting factory. The model of the five sheeting machines in Cascade formation was constructed by the Federated Engineering Co. Ltd., Kuala Lumpur, and the firm is to be congratulated on this excellent model. This battery was operated by a small 1 H.P. motor.

All the remaining equipment in this factory, including ramp for lorry tank, straining trough, settling and bulking tanks, straining tank, water supply pipes. trough for distribution of latex, coagulating tanks of various designs, chute for conveying coalgulum to the sheeting machines and between each machine. soaking tank and rack on wheels for smoking and drying rubber on the flat was constructed by the well known Swiss firm of Diethelm & Co., Singapore, who were also responsible for the complete lay-out.

Messrs. Schweizer and Schmid of this firm were in attendance during the whole period of the Exhibition in order to give advice and demonstrations.

The advice and assistance rendered by these representatives of the firm were much appreciated by visitors.

It might be mentioned here that, although the Institute is aware that it is not possible at this time for most estates to re-organise their factories on the lines proposed, there are a number of ideas embodied in the lay-out which can probably be adopted. The main object, however, of the model is to emphasize that central factories on the lines shown should be the aim of the plantation rubber industry.

A factory with a similar lay-out is already in existence on one estate in Malaya and the output amounts to 1,500 lbs. of dry rubber per hour, which can be increased to about 1,700 lbs. per hour.

Planters will also be interested to know that this model has been presented to the Institute and will be available at all times to visitors who are interested.

A number of other appliances and apparatus suitable for rubber estate factories, including the new all-aluminium tank were exhibited by this firm.

Other aspects of Rubber Estate factory problems in the preparation of rubber were demonstrated by the Chemical Division of the Institute by means of, (a) defective specimens of sheet and crepe rubber specially illuminated to show these defects, (b) photographs and diagrams.

The importance of settling and straining latex for the preparation of sheet rubber was demonstrated by means of exhibits and photographs.

Another exhibit in the Chemical Section, which attracted considerable attention, was the small drying chamber heated by means of low-voltage electric current with sheets laid flat on racks to effect economy in drying space.

A few of the important non-constituents separated from rubber latex, viz: quebrachitol, protein and lipin substances were exhibited.

Botanical Section.

The budding of Hevea rubber was illustrated by the Botanical Section by means of an excellent series of enlarged photographs, showing the sequence of operations and also by anatomical specimens. Budding demonstrations were also arranged at four periods during each day of the Exhibition.

In addition, a series of young plants of well known clones were exhibited in order to illustrate some of the important vegetative characters by means of which many of these clones can be identified.

Pathological Section.

The Pathological Division concentrated chiefly on Root disease of the rubber tree and staged an excellent collection of material illustrating the most important root diseases (Fomes lignosus and Fomes pseudoferreus) and their method of spread and treatment.

Detailed printed narratives attached to each exhibit enabled interested visitors to obtain information on these diseases. Photographs and drawings were also displayed to supplement the specimens.

Another important exhibit in this Section consisted of two tanks with glass sides, demonstrating the growth of Fomes lignosus in soils and illustrating in one tank that an application of as much as 4 tons of lime per acre was ineffective in preventing the growth of the mycelium of this fungus in the soil.

Exhibits were also staged to demonstrate the effect of die-back caused by weak parasitic fungi on wounds or cuts made in pruning, when suitable wound dressings are not applied. The satisfactory results obtained by the use of asphalt-kerosene mixtures as recommended by the Institute were also demonstrated.

Soils Section.

The Soils Division concentrated on a valuable but technical exhibit, showing the main classification of soils on a climatological basis. The collection included a large series of rubber estate soils examined at the Institute, a collection of the principal nitrogenous, potassic and phosphatic fertilizers used on estates and graphs illustrating the effect of the application of fertilizers on Malayan rubber estates.

Publications.

A Publication Stall completed the exhibits staged by the Rubber Research Institute.

Since the ordinary publications of the Institute are circulated free to all estates in Malaya, it was not anticipated that there would be much demand for these. The revised sets of Information Cards on the preparation of and defects in raw rubber, however, were in considerable demand.

General.

Judging from the remarks made by planters and other visitors to the Rubber Section and letters since received, there is little doubt that this Section, in spite of present conditions, proved an unqualified success and was of considerable educative value.

CONDITIONS IN SMALL RUBBER HOLDINGS IN MALAYA.

Second Quarter, 1931.

The Weather.—Normally the second quarter of the year is a period of fairly heavy rainfall over the greater part of the Peninsula. In respect of total rainfall the period under review departed little from normal conditions, but the heavier precipitation appears to have been towards the end of the quarter rather than, as is more usual, at the beginning. A very wet June was experienced generally this year, whilst in April and May the rainfall seems to have been generally slightly below the average. Even the West Coast stations appear to have shared in the heavier June precipitation, an exception being Port Dickson where dry weather was reported for the month.

Prices.—Local prices have been lower than during last quarter. Reports of prices paid to small holders for their rubber reveal the great range noted last quarter, but without any noticeable monthly variation. Thus, in cents per kati, the range for smoked sheet was from 8 to 14 cents and for unsmoked sheet from 5 to 13 cents. Prices for scrap and lump still show the great range of from 2 to 7 cents. The equivalents in cents per pound are:—

Smoked Sheet	6	to	10½ cents.
Unsmoked Sheet	3¾	to	9¾ cents.
Lump and Scrap	1½	to	5¼ cents.

The monthly average Singapore prices for standard smoked sheet were:—

April	9.7 cents per lb.
May	9.1 „ „ „
June	9.5 „ „ „

General.—The tendency noted last quarter for small-holders to turn their attention to crops other than rubber, has become more marked during the period under review. As the change over is almost entirely to food crops, it indicates that a number of Asiatics realise that, under present conditions, it is necessary for them to produce food for themselves, as they are not in a position to continue to buy it as they have been in the habit of doing in the past. Thus, although the matter may be of some possible importance as regards the economics of the small-holder, it has little to do with economics of rubber excepting that it may temporarily reduce outputs to a small extent owing to the cessation of tapping whilst owners are engaged on planting food crops.

The area out of tapping has considerably increased during the quarter. This is mainly due to increased activities in preparing land and planting the padi crop. It is estimated that in Negri Sembilan some 5,600 acres of small holdings are out of tapping and that in Province Wellesley about 70 per cent. of the small holdings are closed down, the figure for Penang being approximately 80 per cent.

Investigations.—During the quarter a scheme for obtaining information regarding the bark consumption, bark reserves, bark renewal and yields of small holdings was decided upon after discussion between the Rubber Growers' Association, the Department of Agriculture and the Rubber Research Institute. A grant of $10,000/- has been made from the Rubber Experiment and Research and Propaganda Fund and placed at the disposal of the Director of Agriculture for the purpose. The scheme provides for taking monthly measurements on one hundred selected representative small holdings, situated throughout Malaya. At the end of the quarter final details have been worked out and decided upon and everything is in readiness for selecting the holdings to be used, and for first measurements and records to be made. It has to be admitted that reliable information as regards the capabilities of rubber under small holding conditions is almost entirely lacking. Statistics clearly indicate that general ideas on the yields of small holdings that obtained in pre-restriction days were very far removed from actual facts. It is no less possible that common present days views on the questions of bark consumption and renewal, and bark reserves on small holdings, may be just as far removed from the truth.

It is hoped that the scheme decided upon will, after the course of twelve months, place at our disposal sufficient information to provide a basis for calculation, instead of the matter being one largely of pure conjecture as it has been in the past.

Disease.—(a) *Oidium leaf mildew.* Further cases were reported from areas in Malacca and Negri Sembilan in April, but the outbreak was both less severe and less protracted than the similar outbreak which occurred over the same area at a similar time last year.

(b) *Mouldy Rot.* The wet weather resulted, as usual, in increased activity of the fungus causing this disease. Control was fairly satisfactory in most areas, although the difficulties of inducing small-holders to carry out really effective treatment are greatly intensified by the present economic conditions.

Departmental.

FROM THE DISTRICTS.

The Weather.

Over the major portion of the Peninsula the rainfall for the month was above the average and was generally evenly distributed. At most of the inland stations figures are well in excess of the recorded mean for the month and this applies to many of the West Coast Stations, although in some of these the figures approximate more closely to the normal and, in a few cases, are slightly below average.

Remarks on Crops.

Rubber.—Prices paid by local dealers to the small-holders are very slightly below those for last month. The following quotations are the prices per pikul. Smoked sheet, from $8 to $13 : unsmoked sheet, from $7 to $11 : Scrap, from $2 to $6. In Krian district of Perak a considerable quantity of slab rubber is prepared in a somewhat crude manner and realises from $6 to $7 per pikul, most of it being bought by dealers in Penang. A much smaller amount is prepared also in Larut district.

Good progress has been made in selecting holdings for investigations regarding bark consumption, bark reserves and yields on small holdings. Most of the holdings considered necessary for the purpose in the Federated Malay States and Straits Settlements have been selected and the trees have received the preliminary marking, preparatory to the first records being taken.

The unusually wet weather experienced has resulted in continued activity of the Mouldy Rot fungus. Efficient control on small holdings is becoming increasingly difficult as the poorer owners are very reluctant to spend money on the fungicides required and the presence of undergrowth in many holdings provides conditions particularly favourable to the growth of the fungus.

Padi.—Planting of the crop is practically complete in Negri Sembilan (except Kuala Pilah District) and the inland Districts of Malacca and Selangor. Elsewhere, preparation of land is progressing under favourable conditions. Some delay in cultural operations has been occasioned by excessive water in parts of Malacca.

In Malacca the Department sold approximately 8 tons of Perlis Guano to cultivators at the cost price of $1.10 a pikul. It is being tried as a substitute for bones in the "chelup" mixture. "Chelup" refers to the Malacca custom of dipping the roots of young plants in a wet manurial mixture before planting. The great demand for Perlis Guano is occasioned by its present low cost as compared with the price of bones.

Tobacco.—Interest in this crop is well maintained. The area in Province Wellesley now totals about 50 acres. The Rangoon type imported into this

Settlement is making good growth and looks very promising but, harvesting not yet having taken place, it remains to be seen whether the type will provide a suitable leaf for the local market. The highest price obtained for cured leaf during the month was $45/- a pikul. Interest in the crop is newly reported from Pahang and there is some prospect of a further area of 6 acres being opened at Port Dickson.

Agricultural Stations and Padi Test Polts.

Province Wellesley.—The Seraup varieties of padi have received their first transplantation at Bukit Merah Padi Station and these and other similar long maturation varietes have been sown at Glugor. The trials at Glugor with short season varieties during the intercrop season are proving a failure. Two varieties are fruiting, but birds eat the grain as fast as it is produced and, notwithstanding all efforts to prevent it, rats continue to do damage.

Perak.—(a) *Agricultural Stations.* At Selama the area has been demarcated and reservation applied for. A lay-out has been decided upon and material ordered for planting. Steps have been taken for the erection of buildings. At Kuala Kangsar some tobacco was harvested and is being cured. Wet weather has interfered with this operation. Of the varieties in the field, the local Chinese type and a Virginia variety "Hickory King" are doing well, whilst variety "Joyner" is making very poor growth and is apparently unsuited to the conditions of the station. Groundnuts are doing well but the departmental hybrid local maize is making poor growth. Seedling oranges are being raised as stock for budding.

(b) *Padi Test and Experimental Plots. Selinsing.* Cultivation was completed early in the month. Plants have received one transplantation. *Bukit Gantang.* Preparations for opening this new Test Plot and planting it are complete. *Kamunting Slimed Area.* Nurseries of the Seraup strains have been sown. Tuba root has been placed in the irrigation channels with the object of controlling *Nymphula depunctalis,* a semi-aquatic leaf-eating caterpillar.

Selangor.—Cheras Station. Survey has now been completed and a fencing contract made. Plants are making good growth on both Kuang and Kajang Padi Test Plots. There is less evidence of stem borer damage on the Kuang plot.

Negri Sembilan.—Rembau Station. Preliminary cultivation of the whole area is under way and arrangements have been made to disc harrow later. *Seremban Station.* Late crops of Oranges (Valencia Late) have suffered much less damage from the fruit fly than did earlier crops. A good crop of Salisbury White maize was harvested. *Rembau Padi Test Plot.* Nurseries were sown. Some damage was done by birds to two varieties which necessitated resowing.

Pahang.—(a) *Agricultural Stations. Kuala Lipis.* Plots of Maize and Groundnuts were harvested. *Temerloh.* Rain has delayed burning the felled jungle. Posts have been prepared for fencing. *Kuantan.* An amended lay-out

was approved and work on draining has been put in hand. *Pekan.* Yam and Sweet Potatoes were planted and the fruit area cleaned up preparatory to planting a cover crop.

(b) *Padi Test Plots. Dong.* Ploughing and harrowing is in progress. Plants in the nurseries are making good growth.

Tenders have been invited for the erection of a store.

Temerloh.—Planting is delayed as some plants are not large enough to stand transplanting into the deep water present on some parts of the plot. The planted area is doing well.

Pekan.—Stem borer damage has been noted in the area planted up.

Malacca.—Burning off has been delayed by rain on the Sungei Udang Station. At Pulau Gadong Station, nurseries have been sown for the checker-board and multiplication plots and transplanting of the ear-to-row selections is in progress. At Alor Gajah Test Plot the transplanting of the earlier sown varieties has been completed.

Kedah.—Good progress was made with the preparation of land for planting at Telok Chengai Padi Station, as well as at Padi Test Plots at Rantau Panjang, Jitra, Langgar and 17th mile, Sungei Patani Road. The lay-out and planting programme for these Test Plots has been formulated.

DEPARTMENTAL NOTES.

The Malayan Exhibition.

The annual exhibition organised by the Malayan Agri-Horticultural Association provides an opportunity of bringing the public more closely in touch with the work of the Department of Agriculture. In past years the event has enabled the Department not only to demonstrate particular crops or agricultural products of Malaya, but to shew the scope of recent work of the Department. A departure from this system was made at the Malayan Exhibition, held at Kuala Lumpur from August 1st to 3rd for the Departmental exhibits were confined to relatively a few subjects in order that they might be treated more thoroughly and leave a deeper impression than would a collection of exhibits of a diverse nature.

Pride of place amongst the exhibits was given to food products, shewing those that are suitable for cultivation in the lowlands and those more suited to the highlands of Malaya. In some cases, the various stages of production were shewn, such as the growing plant, the raw and the commercial product. In view of the dependence of Malaya on imports of almost all foodstuffs, these series of exhibits were of great importance and roused keen interest.

Considerable investigations have been undertaken during the past few years towards improving the yielding capacity of local varieties of rice and of adapting varieties to the differing local conditions encountered in the country. An exhibit illustrative of the results of this work is now an annual feature of the Departmental exhibit and never fails to attract the attention of the large number of Malay small-holders who visit the exhibition.

Other prominent features of the exhibits staged by the Department were concerned with coffee and lowland tea.

The Department has investigated the local demands regarding quality of coffee with a view to supplying the needs of the country by local production. Samples of coffee grown at Serdang were shewn as fulfilling these local requirements. The Entomologist staged an exhibit illustrative of the Coffee Berry Borer and demonstrating how the serious damage by this pest may be obviated. A sample of Arabian coffee grown at the Government Experimental Plantation, Cameron Highlands also attracted much attention.

The erection recently of a tea factory at the Government Experimental Plantation, Serdang made it possible for the Department to shew the commercial product, which has been manufactured on the Plantation. Furthermore, living specimen tea plants of different "jats" grown at Serdang, most of which had reached the bearing stage, were exhibited.

A very fine samples of cloves grown at Serdang was shewn and is worthy of mention, especially as it refutes the general impression that this plant will only thrive within sound of the sea.

The English, Malay and Chinese publications of the Department were

displayed for sale, while officers conversant with these three languages were present throughout the duration of the Exhibition to deal with enquiries of an agricultural nature.

Poultry for Fraser's Hill.

A consignment of poultry, comprising 5 White Leghorns, 6 Rhode Island Reds and 6 Light Sussex has been received from South Africa. One White Leghorn hen died on the voyage, but the remainder arrived at Fraser's Hill in good condition and are excellent specimens of the breeds they represent.

Publications.

Two special Bulletins of the Scientific Series have recently been published. They are :—

No. 5. The Bionomics of some Malayan Rhynchota (Hemiptera-Heteroptera) by N. C. E. Miller. Price $1.

No. 6. Stem-Rot of the Oil Palm in Malaya by A. Thompson. Price 50 Cents.

These publications will be reviewed in a subsequent number of this Journal.

The second quarterly number of the Chinese Agricultural Journal of the Department was published in June. It contains special articles on Rat Destruction in Malaya and on the Quality of Copra.

Staff Changes.

Mr. F. R. Mason, returned from leave and resumed the duties of his appointment as Agricultural Field Officer, Penang & Province Wellesley on the 15th July, 1931.

Mr. H. J. Simpson to act as Agricultural Field Officer, Selangor, from 15th July, 1931.

Raja Mohamed bin Raja Aman to act as Agricultural Field Officer, Perak South, from 15th July, 1931.

Statistical.

MARKET PRICES.

July, 1931.

Rubber.—The Singapore spot price of Ribbed Smoked Sheet rubber equal to London Standard stood at about 10½ cents per lb. during the first week of the month, thereafter gradually declining until the price reached 8¾ cents at the end of the montth. The average Singapore price for the month was 9.7 cents per lb. as compared with 9.5 cents per lb. for June. The average London price was 3d. per lb. which was also the average price throughout May and June.

Palm Oil.—Prices shew little change. Latest information received during July quote July/August Shipment C.F.I. London @ £16.5.0.

Copra.—Prices have declined, but Singapore values have been relatively high due to the demand of local mills. Supplies are heavy. Sundried copra opened at $5 per picul and for a short time stood at $5.30 per picul. The price then declined, closing at $4.25 per picul. The average Singapore price for July was $4.70 per picul for "Sundried", "Mixed" being 25 cents per picul below this price. The average Singapore prices for June were $4.23 per picul for "Sundried" and $3.99 per picul for "Mixed". Copra remains around $1.75 per picul.

Gambier.—Prices have appreciated slightly, at the end of the month "Block" being quoted at $10 and Cube No. 1 at $19 a picul. Average prices were; Block $9.50; Cube No. 1 $18.80.

Rice.—The average declared trade value of imports of rice into Malaya for the month of June was $3.67 per picul compared with $3.83 per picul for May.

The average retail market prices per gantang of No. 2 Siam rice in June were:—Singapore 30 cents, Penang 28 cents, Malacca 25 cents. The corresponding prices for May were 32,38 and 35 cents per gantang respectively.

Arecanuts.—Palembang Whole averaged in Singapore $4.17 per picul during July, mostly purchased for the Hongkong market. The average price for this grade in June was $3.82 per picul. Bila Whole averaged $3.64 per picul in July as compared with $3.50 in June. For other grades, the average prices ranged as follows:—Sliced $5.55 to $13.62; Red Whole $6.19 to $8.00; Split $3.66 to $6.09; Kelantan Split $5.85 to $6.15, the price within each range depending on quality. The cheaper priced Sliced and Red Whole have found a slightly improved market in India, while the higher qualities have been saleable in the Annam market.

Coffee.—Owing to small arrivals of the best quality of Java Robusta, prices improved somewhat but declined towards the end of the month. The Singapore prices of Java Robusta averaged $17.62 to $19.06, as compared with $16.87 to

$18.94 per picul in June, the price within the range in each case depending on quality. The average price during July for Palembang coffee was $12.79 per picul as compared with $12.87 for the previous month.

Pineapples.—Business is now small and the market dull. Average prices per case for July were:—1½ lb. cubes, $3.48; 1½ lb. sliced flat, $3.35; 1½ lb. sliced tall, $3.51. Corresponding prices in June were $3.50; $3.36; $3.37 respectively.

Tapioca.—Moderate transactions are reported, but prices sagged at the end of the month. Average prices per picul were:—Flake fair, $3.47; Pearl, seed, $4.43; Pearl, medium, $5.00 as compared with $3.19; $4.19 and $4.90 respectively in June.

Sago.—Market for sago flour is quiet but steady with moderate business passing. Average prices per picul in July were as follows:—Pearl, small fair $4.39 as compared with $4.49 in June; Flour, Sarawak fair, $1.84 as compared with $1.78 in June.

Pepper.—Prices remained firm until heavy arrivals of the new crop of Muntok which resulted in some pressure to sell on the part of importers and consequent lower prices. Average prices per picul in July were:—Singapore Black, $19.20; Singapore White, $30.80; Muntok White, $31.45. Corresponding prices in June were $18.12; $29.75 and $30.75 respectively.

Cloves.—Zanibar cloves dropped from $50 to $43, the average for the month being $46.60 per picul as compared with $52 in June. Amboina cloves dropped from $52 to $48 per picul, the average price for July being $49.40 as compared with $56 per picul in June.

Mace.—The high prices realised at the beginning of July were not maintained, the demand now being poor and the market still shewing a downward tendency. Siouw fell from $70 to $49, the average for July being $56.10 per picul as compared with $51.75 per picul in June. Amboina started the month at $47 but fell to $33, the average price for July being $39.30 per picul as compared with an average of $38.12 in June.

Nutmegs.—Nutmeg prices appreciated greatly at the beginning of July but fell rapidly owing to poor demand. Average prices per picul for July were:—110 per lb., $23.80; 80 per lb., $33.80 as compared with $20 and $26 per picul respectively in June.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm Oil Reports are kindly supplied by Messrs. Lewis and Peat (Singapore) Ltd., and the Singapore prices for Coffee and Arecanuts by the Lianqui Trading Company of Singapore.

1 picul = 133⅓ lbs. 1 coyan = 40 piculs.

The dollar is fixed at two shillings and four pence.

MALAYA RUBBER STATISTICS

TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF JUNE, 1931, IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres (estimated) 2		Imports				Exports (including re-exports)				Stocks at end of month		
								during the month		during the year 1931		during the month		during the year 1931				
	Ports	Dealers	Estates of 100 acres and over	During the month	during the year 1931	during the month	during the year 1931	Foreign	From Malay States	Foreign	From Malay States	Foreign	Local	Foreign	Local	Dealers	Estates of 100 acres and over	Ports
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES :—																		
Federated Malay States	...	12,296	13,273	11,316	67,483	8,727	52,009	Nil	Ni	Nil	26	11,743	6,678	78,114	41,869	13,679	13,512	...
Johore	.	2,315	3,995	3,408	20,882	3,652	23,350	Nil	3	Nil	12	781	6,522	4,415	40,605	2,301	3,769	...
Kedah	.	416	2,148	2,024	12,020	1,079	6,328	Nil	Nil	Nil	Nil	578	2,479	3,688	15,099	395	2,215	...
Perlis	.	9	5	5	44	13	66	Nil	Nil	Nil	Nil	Nil	17	Nil	116	9	6	...
Kelantan ...	..	179	78	163	1,040	519	2,513	Nil	Nil	12	Nil	83	496	430	3,091	208	152	...
Trengganu ...	.	55	50	113	580	57	290	Nil	Nil	Nil	Nil	Nil	170	Nil	870	55	50	..
Total Malay States	.	15,270	19,549	17,029	102,049	14,047	84,556	Nil	3	12	38	13,185	16,362	86,647	101,650	16,647	19,704	...
STRAITS SETTLEMENTS																		
Malacca ...		2,378	1,375	1,246	7,019			Nil		Nil		3,371		27,918		3,052	1,389	...
Province Wellesley		151	532	463	2,581	(2)	(2)	Nil		Nil						133	595	...
Dindings ...		94	92	99	555	2,626	13,163	Nil	16,416	Nil	101897	5,012	Nil	36,329	Nil	116	109	...
Penang	1,025	4,476	9	7	44			610		4,313						5,139	6	1,475
Singapore ...	3,600	32,470	344	170	1,088			9,265		48,919		17,779		108,206		33,636	298	4,440
Total Straits Settlements	4,625	40,069	2,352	1,985	11,287	2,626	13,163	9,875	16,416	53,232	101,897	26,162	Nil	172,453	Nil	42,066	2,397	5,915
TOTAL MALAYA	4,625	55,339	21,901	19,014	113,336	16,673	97,719	9,875	16,419	53,244	101,897	39,347	16,362	259,100	101,650	58,713	22,101	5,915

TABLE II

DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Total
20	21	22	23	24	25	26
DRY RUBBER	11,171	31,552	4,656	3,114	963	51,456
WET RUBBER	2,508	2,074	483	187	1,338	6,590
TOTAL ...	13,679	33,626	5,139	3,301	2,301	58,046

TABLE III

FOREIGN EXPORTS

PORTS	For month	during the year 1931
Singapore ...	26,363	168622
Penang ...	8,608	59,620
Port Swettenham	4,223	27,913
Malacca ...	153	2,945
MALAYA ...	39,347	259100

TABLE IV

THE PROPORTION OF FOREIGN EXPORTS REPRESENTING DOMESTIC PRODUCTION 4

AREA	For month	during the year 1931
Malay States ...	30,152	206797
Straits Settlements		
MALAYA ...	30,152	206797

Notes :—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained

2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [19A] estimated—[2]—[3]—[4]—[5]—[9]—[10]. For the Straits Settlements, the figure represents purchases by dealers from local estates of less than 100 acres.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. The proportion of foreign exports representing Malayan domestic production is estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5. The above, with certain omissions, is the Report published by J. I. Miller, M. C. S., Acting Registrar-General of Statistics S.S. and F.M.S., at Singapore on 22nd July, 1931.

GENERAL RICE SUMMARY.*

June, 1931.

Malaya.—The net imports of rice into Malaya for June amounted to 40,774 tons. Of total imports 47 per cent. was from Siam, 42 per cent. from Burma, 5 per cent. from French Indo-China and 1 per cent. from other countries.

The total imports of rice into Malaya for the first half year 1931 were 347,000 tons, the net imports (consumption of foreign rice) being 262,000 tons, or 32,000 tons less than for the corresponding period of 1930.

Stocks of padi and rice held by wholesale dealers and millers in the Federated Malay States and Straits Settlements at the end of May were :—padi 16,736 tons; rice 26,770 tons. These stocks, converting padi at 62 per cent. and adding estimated stocks in Johore and on estates amount to 50,636 tons of rice.

Harvesting has been completed throughout Malacca, the greater part of Perak, including the Krian irrigation area, and Perlis. Cultivation is in progress in most other areas. The heavy rains experienced in June have assisted this work in many districts.

India.—Total foreign exports of milled rice during January to April 1931 were 802,000 tons, a decrease of 482,000 tons as compared with the corresponding period of 1930 and a decrease of 172,000 tons as compared with the average exports of the corresponding period for the past 6 years.

It is reported that the Burma export of rice and rice products from January 1 to June 6, 1931, was 1,878,746 tons as compared with 2,117,503 tons for the same period of the previous year, or a decrease of 11.3 per cent.

Japan.—An official communication states that the area under rice during the first crop of 1931 was 677,978 acres, being 18,358 acres more than the previous year, due to the abundance of water at the time of planting. The estimated production is 502,933 tons, being 14,506 tons or 2.97 per cent. more than the 1930 figure and 14.8 per cent. above the average for this crop during the past five years.

Siam.—The exports of rice from Bangkok, from December to May inclusive were 638,000 tons as compared with 644.000 tons for the corresponding period of the season 1929—31.

The production of rice for the year 1930—31 shews a marked increase over previous years. The area of land planted with padi in the seven main exporting circles was 4,623,736 acres, being 108,404 acres more than in the previous year. Moreover, the damaged area was considerably less than in the previous year.

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*The following is an abstract of the General Rice Summary for June, 1931, compiled from various sources by the Registrar-General of Statistics, S.S.

Java, Madura and N.E.I.—At the end of May the area under "wet" padi was estimated to be 7,251,000 acres, being about 25,000 acres more than in 1930, while the area under "dry" padi was 1,165,000 acres, or 13,000 less than in 1930.

The Netherlands East Indies imported 288,000 tons of rice during January to May, or 61,000 tons less than for the same period of 1930.

French Indo-China.—For the first half year 1931 exports of rice were 526,450 tons as against 709,620 tons for the corresponding period of 1930.

Prices of padi remain firm and stocks in hand are barely able to cope with the business done. The temporary jump in the price of silver caused a similar increase in the price of padi.

The rice market was active in June, but at the same time the only market interested at present prices was France. Practically no business was done with any Far Eastern market. At the end of the month the tendency was very steady.

Ceylon.—Imports into Ceylon, January to May inclusive were 179,328 tons against 196,483 tons for the corresponding period of 1930.

Europe.—The quantities of rice shipped from the East were, according to the London Rice Brokers' Association Weekly Circular dated June 11, 1931 :—

To Europe during the period January 1 to June 11, 522,000 tons, an increase of 18.1 per cent.;

To the Levant, period January 1 to April 26, 16,000 tons;

To the West Indies and America, period January 1st to May 13, 85,000 tons.

METEOROLOGICAL SUMMARY, MALAYA. JUNE, 1931.

Locality	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes						Total		Most in a day	Number of days					Total	Daily Mean	Per cent
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet			Amt.	Precipitation* .01 in or more.	Precipitation, .05 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more			
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						hr.	hr.	%
Railway Hill, Kuala Lumpur, Selangor ...	90.9	73.2	82.1	95	69	85	75	84.9	85.6	6.27	169.3	1.60	17	13	4	1	3	178.10	5.94	48
Bukit Jeram, Selangor ...	88.9	74.1	81.5	92	72	84	76	85.4	87.4	4.08	103.6	1.18	13	9			1	198.65	6.62	54
Sitiawan, Perak ...	90.1	73.7	81.9	94	70	84	76	85.3	85.7	9.87	250.7	2.55	12	9	3			204.40	6.81	
Kroh, Perak ...	86.9	70.9	78.9	91	67	79	73	82.3	83.2	10.60	269.2	2.34	18	16	2	5		165.70	5.52	
Temerloh, Pahang ...	90.2	73.8	82.0	94	72	83	75	86.0	87.1	6.07	154.2	1.63	17	13	5	11		173.90	5.80	47
Kuala Lipis, Pahang ...	89.0	72.9	80.9	92	71	84	75	84.3	85.0	3.79	94.0	0.77	12	11	10	17	1	148.10	4.94	40
Kuala Pahang, Pahang ...	87.3	75.1	81.2	91	72	83	79	85.4	86.0	5.97	151.7	1.96	13	10	4			213.50	7.12	58
Mount Faber, Singapore ...	88.3	76.9	82.6	93	73	79	81	82.6	83.9	10.17	258.3	2.27	14	11				193.20	6.44	53
Butterworth, Province Wellesley ...	88.1	75.2	81.7	91	73	84	79	85.9	86.5	12.13	308.1	3.32	17	14	2		1	191.70	6.39	
Bukit China, Malacca ...	85.6	74.4	80.0	88	70	81	77	82.9	84.3	15.20	386.1	5.34	15	14	3			203.00	6.77	55
Kluang, Johore ...	88.3	72.4	80.3	93	70	79	77	82.5	83.2	9.25	235.0	2.25	19	16	4	9		168.30	5.61	46
Bukit Lalang, Mersing, Johore	88.3	73.3	80.8	92	71	79	77	83.5	83.6	5.06	128.5	1.90	13	10				203.90	6.80	55
Alor Star, Kedah ...	88.4	75.1	81.7	93	72	81	78	86.6	87.0	18.91	480.3	6.50	21	19			1	189.85	6.33	51
Kota Bahru, Kelantan ...	90.3	74.4	82.3	93	73	86	77	85.5	86.0	4.13	104.9	0.88	15	12	1			186.70	6.22	50
Kuala Trengganu, Trengganu	90.2	74.2	82.2	95	72	85	77	85.3	86.5	2.94	74.7	0.74	10	7	1			214.30	7.14	58
HILL STATIONS.																				
Cameron Highlands, Rhodendron Hill, Pahang 5120 ft. ...	73.3	60.6	66.9	77	58	67	63			4.75	120.7	1.23	17	15		2	1	148.10	4.94	40
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	73.9	57.7	65.8	78	53	68	62	71.8	71.0	4.89	124.2	0.90	17	15		2	1	144.50	4.82	39
Fraser's Hill, Pahang 4268 ft.	75.3	63.1	69.2	79	60	68	65	72.2	73.0	7.89	200.4	1.52	20	17	3	17	1	154.60	5.15	42

Compiled from Returns supplied by the Meteorological Branch, Malaya.